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THE EFFECT OF PRACTICE UPON VISUAL APPREHENSION IN THE FEEBLE-MINDED[1]

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I. INTRODUCTION

In the experiment on the effect of practice in visual apprehension which we performed upon second grade school children,[2] we learned that the group classified as "poor," and composed, upon the basis of the performance in the first week's work, of the lower third of the class, made a slow and continued improvement; whereas, the groups classified as "medium" and "superior" made, what we have learned to expect in practice experiments, a large improvement in the earlier and a small improvement in the later stages. The "poor" group ultimately came to surpass the record of the "medium" group, and to approach that of the "superior."

Problem.—Since the "poor" group was composed of the most backward children in the class, most backward not only in respect to their performance in the tests of visual apprehension, but also in respect to class standing and teacher's estimate,[3] it was deemed advisable to extend the work to a class of feeble-minded children in order to discover whether a continued improvement in visual apprehension is characteristic of backwardness, and whether the effects of practice are as great as in the case of the lowest third of a normal group.

As in the earlier experiment, our results are purely quantitative, and we refer for their interpretation to the introspective studies that have been made upon this subject.[5]

[1]The experimental work was performed at the Ohio State University.

[2]DALLENBACH, K. M., *The Effect of Practice upon Visual Apprehension in School Children.* THIS JOURNAL, V, 1914, pp. 321–334; 387–404.

[3]*Op. cit.*, pp. 388, 400, 401.

[5]WHIPPLE, G. M., *The Effect of Practice upon the Range of Visual Attention and Visual Apprehension.* THIS JOURNAL, I, 1910, pp. 249–262.

FOSTER, W. S., *The Effect of Practice upon Visualizing and upon the Reproduction of Visual Impressions.* THIS JOURNAL, II, 1911, pp. 11–22.

Subjects.—The subjects were inmates of the State Institution for the Feebleminded at Columbus, Ohio.[6] Forty-two children, nineteen girls and twenty-three boys, took the tests. We found, however, when it came to the grading of the results that the records of one girl, who was partially paralyzed, had to be discarded as they were illegible.

An effort was made when we were selecting our subjects to choose children who would compare mentally with those who served in the previous experiment. Unfortunately no mental tests had been given in the earlier work, and we had no definite knowledge of the subjects' mental ages; but as the drill was given in the second grade during the second semester we felt safe in assuming that the average mental age was between 7 and 8 years. Accordingly, subjects were selected from the school for feebleminded whose mental ages at the time of their admission to the institution, as determined by the Binet-Simon tests, averaged 7.5 years, with a mean variation of 0.58 years. The chronological age ranged from 10 to 18.

II. METHOD AND RESULTS

A. Method of Procedure

1. Material.—The same kind of material was used as in the earlier work,[7] namely: I. numerals; II. letters; III. combined numerals and letters; IV words; V. combined numerals, letters, and words; VI. geometrical figures; and VII various materials, numbers, letters, figures, signs, etc., arranged in a "tit-tat-to" frame. These seven types were each divided into a number of sub-types of greater and lesser difficulty.

In the first five types, the material on the one half of the cards appeared in a vertical column, and on the other half in a horizontal row. All the material was printed by hand in India ink on white card boards 11x14 inches in size. All letters, numerals, and other characters upon the cardboard were 2 inches in height. The letters and numerals were printed in script and block; the letters in both upper and lower case.

2. Plan of Experiment.—Exactly the same procedure was followed as in the earlier experiment. The work was divided into nine periods—a preliminary practice, five test, and three drill periods. The experiment began on the 21st of February, 1916, and ran to the 2nd of March, 1917.

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[6]The writer takes this opportunity to thank Dr. E. J. Emerick, superintendent of the institution, for the privilege of conducting the experiment and also for permission to use the institutional records.

[7]Pp., 326–330.

The plan of the experiment in outline, is as follows:

WEEK	WORK	DATE
1	Preliminary Practice Series	February 21–February 25
2	Test Series A	February 28–March 3
3–6	Drill Series 1	March 6–March 31
7	Test Series B	April 3–April 7
8–11	Drill Series 2	April 10–May 5
12	Test Series C	May 8–May 12
13–16	Drill Series 3	May 15–June 9
17	Test Series D	June 12–June 16
53	Test Series E	February 26–March 2

The material presented in the *Preliminary Practice Series* and the five *Test Series* was an exact duplicate of that given to the normal children, and was printed in block and in small letters. The *Preliminary Practice Series* was composed of the easiest types of material. We hoped by means of it, not only to familiarize the subjects with the experimental method, but also to obtain a basis for classification into poor, medium, and superior groups. The *Test Series* was composed of difficult types of material, and consisted of two sets of test cards. One set was used for Test Series A, C, and E, given 9 and 41 weeks apart respectively; and the other set for *Test Series B* and *D*, given 9 weeks apart. The geometrical figures which appeared in the first set of test cards were revolved through an angle of 45° for *C*, and 90° for *E*; and those which appeared in the second set were revolved through an angle of 45° for *D*. The second set of test cards had exactly the same number of elements and the same materials as the first. It was formed by the inversion of the material in the first set. With the materials of the first five types, the order was merely reversed: what was at the head of the line was now placed at the end; what was at the top of the column was now placed at the bottom. The geometrical figures, Type VI, were revolved through an angle of 180.° The same characters were used in Type VII, their relative positions in the "tit-tat-to" frame were, however, changed.

The *Drill Series* differed radically from those of the earlier experiment. They were more systematically planned and presented, and they were printed, as was not true in the other experiment, in both block and script style, and in both capital and small letters.

Drill Series 1 was composed of comparatively simple materials. During the first week, cards were used, the elements of which—counting every numeral, letter, word, line, and character an element—totalled 55 daily; during the second week 57; the third week 59; and the fourth week 63 daily. In *Drill Series 2* the material was gradually made more complex, totalling 66 elements per day for the first week; 68 for the second; 71 for the third; and 75 for the fourth week. This progression toward complexity was continued in *Drill Series 3* in which the first week's work totalled daily 80; the second, 85; the third, 90; and the last, 100. During the last week the most difficult cards from each type of material were selected. The plan of the series may be summarized as follows:

Drill Series	Week			
	1st	2nd	3rd	4th
1	55	57	59	63
2	66	68	71	75
3	80	85	90	100

The girls and boys, as required by institutional discipline, were given the experiments separately; the boys, the first 15 minutes in the morning; and the girls, the first 15 minutes in the afternoon. In both cases the experiments were conducted by the principal of the school, Mrs. Leal, with the assistance of the teachers.[8] The principal stood directly in front of the class and displayed the cards by hand. After a preparatory signal, "Ready, now," the card was exposed by simply turning its face to the class. The teacher stood at the rear of the room, and, with the aid of a stop-watch, designated by a silent signal when the exposure was to be made and when ended. The exposure lasted for five seconds, and immediately after, the subjects individually reproduced upon prepared paper the card that had just been displayed.

A series consisting of 10 cards was shown every day; five of these series were given every week for 18 weeks: no interruptions occurred. There were then, 90 series in all.

As in the previous experiment, the children were not permitted during the exposure to pronounce the materials aloud.[9] There

[8]It is a pleasant duty to acknowledge the debt that I owe Mrs. Kezia A. Leal and the teachers, Miss Josephine Weldon and Miss Harriette Zurmehley, and to express my thanks and appreciation for their interest in the problem. I also wish to thank Dr. J. E. Evans of the department of psychology of the Ohio State University for conducting the experiment for me during *Test Series E.*

[9]Pp., 331.

was a strong incentive at first to do this, but by strict supervision it was soon overcome. Before exposing materials of type VII, the children were instructed to draw the "tit-tat-to" frame in readiness for report.

3. Method of Grading Data.—The method of scoring was exactly the same as that employed in the earlier work.[10] For every element,—figure, letter, word, line or character,—correctly reproduced one unit was credited; for every error of transposition or insertion 0.5 was deducted except in case of words of 3 and 4 letters, when 0.3 and 0.2, respectively, were subtracted.

[10]Pp., 333–334.

TABLE I

Classification, Chronological Age, Mental Age, Coefficient of Intellectual Ability, and Net Scores by Series

Subject	Chronological Age	Mental Age B-S	Mental Age 1st Y-B	Mental Age 2nd Y-B	Coefficient of intellectual ability 1st	Coefficient of intellectual ability 2nd	Average of Preliminary Practice 1st week
Mary K.	15.9	8.2	10.40	11.40	.76	.85	51.54
Beatrice	13.10	8.4	10.80	11.20	.80	.84	51.00
Don	11.2	6.6	9.42	9.00	.83	.76	50.08
Ruth	15.2	7.4	9.42	9.71	.68	.71	49.86
Violet	13.6	7.6	9.85	11.10	.75	.84	49.86
William B.	14.0	8.2	10.60	10.80	.79	.80	49.40
Paul B.	11.0	7.8	8.68	9.14	.75	.80	48.86
John G.	12.10	7.6	9.57	11.00	.74	.84	48.34
Oliver	14.7	8.4	8.39	8.76	.55	.61	47.52
Henrietta	14.0	7.4	11.60	12.00	.89	.94	47.36
William W.	11.11	6.8	8.92	11.30	.69	.91	47.32
Pearl S.	16.7	8.2	10.20	10.80	.75	.79	46.36
Willie K.	13.0	7.2	8.39	9.00	.58	.68	46.78
Charles S.	15.1	8.4	9.28	10.20	.67	.75	45.36
Frances	15.9	8.8	9.28	11.00	.67	.80	45.08
Mary M.	15.11	8.0	7.80	9.57	.47	.70	44.92
DeWitt	13.2	7.0	8.00	8.07	.51	.73	44.80
Audrey A.	15.10	8.2	8.61	11.10	.59	.81	44.02
Daniel	12.3	7.4	8.61	9.14	.63	.70	43.48
Clara	18.8	7.8	8.68	8.76	.56	.57	42.56
Edna	14.3	7.4	8.61	10.40	.60	.77	40.44
Andrew	11.10	7.8	8.84	9.00	.68	.71	40.40
Hazel	16.10	6.8	8.07	8.31	.50	.52	39.96
Gertrude	15.10	9.0	9.42	10.60	.68	.77	38.96
Walter	15.11	8.4	9.14	8.92	.66	.64	38.68
Kasmer	11.0	7.0	8.31	8.92	.67	.77	38.52
Louis	13.0	6.6	9.57	9.85	.73	.76	38.00
Julia	16.6	8.8	8.68	11.20	.60	.82	37.94
Edith	12.1	7.4	8.23	8.31	.56	.58	37.86
Sadie	15.1	7.6	9.42	10.00	.69	.74	37.44
Ralph	13.4	6.8	8.07	8.23	.51	.53	37.30
Leo	14.10	7.4	8.53	8.68	.58	.60	36.84
Freddie	15.0	6.4	8.00	8.00	.49	.49	35.84
Paul L.	10.0	7.0	7.40	8.00	.61	.65	35.34
Pearl J.	17.0	6.8	8.39	9.42	.52	.65	35.20
George H.	14.5	6.8	8.39	8.46	.56	.57	33.10
George E.	15.9	7.2	7.60	8.23	.46	.52	32.84
Jennie	18.2	7.2	8.39	9.42	.52	.65	32.70
John H.	13.0	8.2	8.15	8.23	.54	.55	31.98
William K.	12.1	6.4	7.80	8.46	.51	.60	31.42
Samuel	10.8	6.0	8.07	8.84	.63	.78	28.28

Av. Test Series A 2nd wk.	Av. Drill Series 1 3rd–6th wk.	Av. Test Series B 7th wk.	Av. Drill Series 2 8th–11th wk.	Av. Test Series C 12th wk.	Av. Drill Series C 13th–16th wk.	Av. Test Series D 17th wk.	Av. Drill Series E 53rd wk.
41.90	49.10	50.08	56.25	49.82	57.50	53.10	50.16
40.68	47.58	44.82	53.55	50.88	57.23	50.72	50.86
41.46	47.20	45.24	51.30	50.24	53.01	50.82	
41.24	46.48	45.12	51.53	44.08	46.38	45.30	43.94
46.40	49.50	49.76	52.03	51.32	58.61	54.60	53.12
52.60	53.48	52.16	56.10	51.62	53.18	53.66	51.36
41.72	48.89	45.76	51.89	45.80	46.27	48.70	50.50
44.00	45.37	39.33	49.45	43.83	45.34	45.03	47.20
42.47	45.90	47.08	52.75	47.17	52.66	47.25	
40.10	46.10	45.02	51.02	49.26	53.26	50.42	52.46
44.86	48.60	45.48	50.73	47.10	52.01	50.00	47.10
40.16	45.55	45.24	48.52	49.38	48.12	49.70	48.10
43.46	47.10	46.30	52.23	48.62	49.53	49.00	49.06
43.82	48.34	46.90	51.27	48.94	52.66	46.90	48.04
40.29	45.43	42.86	47.66	45.66	53.47	47.60	47.64
34.74	42.94	44.32	46.93	46.66	40.87	44.06	43.30
40.36	46.43	43.20	50.80	45.26	46.32	43.96	39.70
39.00	42.00	40.78	41.16	40.88	41.15	39.50	42.68
43.92	45.02	41.40	43.61	41.60	41.68	44.24	43.66
36.12	41.58	37.78	45.76	41.46	49.09	40.66	38.82
38.72	42.60	40.15	44.97	42.60	42.16	44.58	43.52
37.22	40.27	41.40	49.65	36.75	40.42	37.50	37.32
35.62	38.75	37.12	43.00	38.12	42.77	39.36	33.44
41.50	46.30	43.64	47.17	42.90	48.74	40.68	43.40
39.30	40.68	37.78	43.71	43.20	46.69	43.68	43.48
37.70	42.30	40.46	45.07	45.38	48.26	45.62	42.52
36.92	41.47	39.60	38.63	41.34	39.36	35.08	38.80
40.20	45.93	47.18	49.20	49.76	52.39	51.18	47.40
33.96	42.60	37.00	47.49	49.92	45.29	43.96	41.50
35.06	39.28	41.78	45.18	42.82	44.49	45.62	44.60
32.80	31.97	31.08	32.47	34.38	39.47	35.18	36.42
36.70	35.34	34.80	38.30	34.20	36.22	37.32	
38.96	43.33	39.75	46.21	42.78	46.13	43.68	37.88
30.00	32.74	26.64	32.48	32.88	34.77	28.00	30.18
28.62	36.54	26.26	35.18	30.30	34.45	28.50	30.80
31.72	35.13	32.57	38.24	39.25	37.86	40.65	29.32
28.68	32.33	33.52	32.80	28.78	31.89	34.12	30.76
32.62	37.42	33.36	39.36	38.68	36.59	39.60	36.02
32.92	38.05	29.74	37.11	33.26	37.46	35.10	31.40
28.12	40.13	35.70	39.30	35.57	36.00	36.15	36.06
30.60	31.50	31.72	30.25	30.40	27.96	32.96	31.16

II. RESULTS

1. PRINCIPAL RESULTS:

a. Classification of Subjects: As in the earlier work,[11] the subjects were classified into three groups, Classes I, II, and III, accordingly as their records during the *Preliminary Practice Series* were good, medium, or poor. The subjects, their classification, chronological ages, mental ages, mental coefficients, and records in the different series are shown in Table I above. This Table corresponds to Table I of the earlier work.[12] A comparison of these two tables reveals the fact that the abnormal children are superior in the *Preliminary Practice Series* and in *Test Series A* to the normal children. This is also very clearly shown in Tables II and III where the class averages for the normal and abnormal appear. Here it will be seen that the abnormal are not only superior as a group, but also class for class.

TABLE II

Average and Mean Variation for Each Class of the Normal and Abnormal in the Preliminary Practice Series

CLASS	NORMAL		ABNORMAL	
	Average	m. v.	Average	m. v.
I	42.72	2.32	48.54	1.54
II	35.32	1.36	41.26	2.46
III	28.56	1.76	34.31	2.40
Total	35.77	5.02	41.54	5.52
Girls	34.26	3.86	42.94	4.82
Boys	36.70	5.00	40 45	5.86

(Note: The totals in this and the following tables are not the averages of averages, but final averages from the original data.)

This is extremely surprising for, as we have noted above, care was taken to choose subjects whose mental ages were presumably comparable to those of the earlier work. Since the tests upon which the mentality of the abnormal children was based were made some three or four years previously, we re-tested[13] our group with

[11]Pp. 334, 388.

[12]Pp. 388.

[13]We are indebted to Dr. Rudolf Pintner of Ohio State University and his class in mental tests for their assistance in this work.

the Yerkes-Bridges point scale in order to discover if they were now of the mental ages that the institutional records indicated.

We found that the abnormal children had advanced in their mental status during the interim since their admission into the institution, and that they were now mentally superior to the group of normal children. This increase and superiority was, as is shown in Table III, a little over a year.

TABLE III

The Average Chronological Age and Mean Variation for Each Class of Subjects for Both the Normal and Abnormal; and the Mental Ages for Each Class of Abnormal Subjects together with their Coefficients of Intellectual Ability

	NORMAL			ABNORMAL							
	Chronological Age		Mental Age	Chronological Age		Binet-Simon Test		Yerkes-Bridges Point Scale		Coefficient Intellectual Ability	
CLASS	Av.	m. v.		Av.	m. v.	Av.	m. v.	Av.	m. v.	Av.	m. v.
I.....	8.65	0.58	No test made, but assumed, since children were normal and in second semester of second grade, that ages between 7-8	13.74	1.43	7.73	0.47	9.68	0.76	0.730	0.069
II.....	8.54	0.92		14.76	1.72	7.78	0.65	8.69	0.40	0.610	0.065
III.....	7.83	0.81		13.95	1.93	7.01	0.43	8.17	0.33	0.552	0.045
Total...	8.36	0.81		14.16	1.72	7.51	0.58	8.86	0.67	0.637	0.085
Girls....	8.07	0.83		15.59	1.34	7.83	0.51	9.21	0.82	0.652	0.098
Boys....	8.54	0.80		13.03	1.36	7.27	0.61	8.59	0.58	0.626	0.087

The average mental age of the abnormal children was, as shown by the Binet-Simon tests, 7.5,—and this was the age that we desired; but as obtained by the Yerkes-Bridges tests it was 8.8. This discrepancy explains in part the initial superiority of the abnormal subjects.

b. The Effect of Practice in the Drill Series. Although the feebleminded children showed superiority in the *Preliminary Practice Series* and *Test Series A*, they nevertheless revealed their inferiority by their reports in the *Drill Series*, and in the other *Test Series*, as well as by the character of their practice curve. These results appear in Tables IV and VI.

TABLE IV

Average Scores of the Abnormals in the Drill Series

Class	Drill Series					
	1		2		3	
	Av.	m. v.	Av.	m. v.	Av.	m. v.
I.....	47.799	1.587	52.044	1.529	51.840	3.280
II.....	42.978	2 031	45.522	2.644	45.240	4.032
II .....,	36.608	3.247	38.628	4.353	37.583	3.896
Total.....	42.604	4.382	45 373	5.702	45.063	5.661
Girls.....	43.648	3.236	46.997	3.826	47.364	5.791
Boys.....	41.787	5.260	44.152	6.749	43.233	6.297

In the Drill Series, the results of which appear in Table IV, there is, after an initial improvement, an actual decrease in the average number of elements correctly reported. This loss, though slight, is uniform for the group, for the different classes, and for the boys. It can readily be explained by the fact that more difficult material was presented during the last series than in either of the preceding ones. As we have shown above there were from 14 to 25 more elements presented each day in *Series 3* than in *Series 2*, and from 25 to 37 more than in *Series 1*. This, to be sure, offered greater opportunities for larger scores, but these opportunities were for the most part outweighed by the disadvantage of greater complexity.

When the results were computed separately according to sex, it was discovered that the boys alone were responsible for the decrease in *Series 3*. The girls had made an improvement in this series; not as great, however, as the loss of the boys, so that their gain was masked in the general results. Upon the basis of the explanation that we have offered above for the loss in this series, the girls apparently were not confused by the greater complexity of the material, or, if they were, not sufficiently to overcome the advantage of greater opportunities for apprehension.

We should be tempted to explain this difference upon the ground that the girls were, as is shown in Table III, mentally superior to the boys, were it not for the fact, as is shown in Table V, which is a reproduction of Table III of the earlier work,[14] that

[14]Pp., 389.

TABLE V

Average Scores of the Normals in the Drill Series

Class	Drill Series 1		2		3	
	Av.	m. v.	Av.	m. v.	Av.	m. v.
I.....	49.059	3.64	56.046	3.37	54.276	3.81
II.....	42.737	2.28	47.852	5.29	47.618	5.34
III.....	40.423	2.64	43.839	5.02	44.325	5.50
Total.....	43.882	3.73	49.137	5.64	48.988	5.64
Girls.....	41.989	3.90	46.746	5.44	47.184	5.69
Boys.....	44.885	3.64	50.719	5.07	50.299	5.42

exactly contrary results were obtained with the normal children. In the present experiment the girls were mentally superior to the boys; in the earlier work the boys were mentally superior to the girls, yet in both cases the girls showed an improvement in *Drill Series 3* and the boys a decline. This difference, therefore, cannot be explained upon a basis of mental age; but appears to be a real sex difference, probably due to the girls sustaining their interest and effort throughout the experiment; whereas the boys probably lost interest toward the end of the work and made correspondingly less effort. This explanation is strengthened by the fact that the *mean variation* of the boys in both experiments is larger than that of the girls, showing at least that the girls' attitude was the more constant.

c. Effect of Practice in the Test Series: The effect of practice in the Test Series is clearly indicated in Table VI:

TABLE VI

Average Score and Mean Variation of the Abnormal in the Test Series

Class	Test Series A 2nd week		B 7th week		C 17th week		D 17th week		E 54th week	
	Av.	m. v.	Av.	m. v.	Av.	m. v.	Av.	m. v.	Av.	m. v.
I.....	43.200	2.27	46.306	2.06	48.432	2.03	49.728	2.46	49.325	2.08
II.....	38.686	1.97	41.262	2.18	42.969	2.57	42.692	3.34	41.834	3.01
III.....	32.366	2.53	33.378	3.43	36.401	4.85	37.010	4.47	34.675	4.07
Total.....	38.223	4.28	40.482	5.69	42.752	5.05	43.269	5.52	41.939	5.86
Girls.....	38.165	3.37	41.792	4.50	44.694	4.60	44.952	4.91	43.986	4.77
Boys.....	38.274	5.01	39.461	5.88	41.233	5.70	41.952	5.92	40.096	6.20

The subjects made a slow and gradual improvement throughout the entire experiment. This relation holds true whether the group is considered as a whole, by class, or by sex. The curve of improvement in all cases is relatively the same, showing a slow and continued rise. It differs, however, in this respect from the normal curve. For as was shown by Whipple[15] and Foster[16] in their work upon adults, ment in visual apprehension is very rapid. After a pronounced initial rise, which may be explained by reference to such determining factors as familiarity with the material; application of more efficient methods of work; the use of tricks of counting, grouping, and naming; and the direction and restriction of attention, there is no appreciable gain. Table VII, which is a reproduction of Table II of the earlier work,[18] gives the records of the normal subjects in the Test Series, and is comparable to Table VI.

TABLE VII

Average Score and Mean Variation of the Normal in the Test Series

	Test Series									
	A 2nd week		B 7th week		C 12th week		D 17th week		E 58th week	
Class	Av.	m. v.	Av.	m. v.	Av.	m. v.	Av.	m. v.	Av.	m. v.
I.....	38.662	3.64	48.256	3.97	48.108	3.32	48.243	2.99	52.400	1.66
II.....	32.266	2.86	43.166	3.64	43.400	2.68	42.650	3.75	45.700	3.77
III.....	30.441	2.08	39.455	2.62	41.176	2.13	43.014	2.08	46.350	1.35
Total.....	33.995	4.40	43.782	4.07	44.376	3.49	44.856	3.46	48.000	3.70
Girls.....	33.392	3.70	41.357	3.86	42.595	3.99	43.452	3.82	48.571	3.01
Boys.....	34.423	3.66	45.536	3.90	45.644	3.61	45.855	3.62	47.666	3.55

A comparison of Tables VI and VII reveals the fact that while the improvement of the feebleminded subjects is very different from that of the normal taken as a group, it nevertheless resembles very closely the improvement of the poorest third, *i.e.*, Class III.

The amount of improvement for both groups of subjects is shown for every Test Series in Table VIII.

[15]Op. Cit., 258 f.

[16]Op. Cit., 16 f.

and by us in our work upon school children[17] the normal improve-

[17]Op. Cit., 334 f.

[18]Pp., 389.

TABLE VIII

The Average Loss and Gain in the Number of Elements Apprehended in the Test Series

Class	Normal				Abnormal			
	Test Series				Test Series			
	B	C	D	E	B	C	D	E
I.....	+ 9.6	−0.1	+0.1	+4.2	+3.1	+2.1	+1.3	−0.4
II.....	+10.9	+0.3	−0.8	+3.1	+2.6	+1.7	−0.3	−0.8
III.....	+ 9.4	+1.7	+1.9	+3.3	+1.0	+3.1	+0.6	−2.4
Total.....	+ 9.8	+0.6	+0.5	+3.2	+2.2	+2.3	+0.6	−1.3
Girls.....	+ 8.0	+1.2	+0.9	+5.1	+3.6	+2.9	+0.3	−1.0
Boys.....	+11.1	+1.1	+0.2	+1.8	+1.2	+1.8	+0.7	−1.8

(Note: These data were obtained from Tables VI and VII.)

This Table clearly presents the points that we have just made, namely: throughout the drill, in *Test Series B, C,* and *D,* the feebleminded and the poorest third of the normal group continue to improve; whereas the superior and medium subjects of the normal group show a large initial increase and then a long plateau. We, therefore, conclude that the characteristic effect of practice in visual apprehension in the backward and feebleminded is a slow and gradual gain; and conversely, that a slow and gradual improvement in visual apprehension is indicative of backwardness.

d. Effect of Practice in the Different Types of Material: The effect of practice upon the different types of material is shown in Table IX.

TABLE IX

Average Number of Elements Apprehended in Each Test Series for Every Type of Material

Test Series	Type						
	I	II	III	IV	V	VI	VII
A.....	4.93	3.96	4.75	3.16	4.73	4.29	3.89
B.....	5.38	4.31	4.82	3.35	4.77	4.09	3.51
C.....	6.13	4.75	5.30	3.62	5.63	4.27	4.44
D.....	6.20	4.84	5.02	3.93	4.96	4.59	3.87
E.....	5.84	4.77	5.07	3.68	4.79	4.40	4.31

I.—Numerals; II.—Letters; III.—Numerals and letters; IV.—Words; V.—Numerals, letters and words; VI.—Geometrical figures; VII.—"Tit-tat-to" combinations.

A steady improvement can be noted in the average number of elements reported in Types I, II, IV, and VI—the pure types, viz., the numerals, letters, words, and the geometrical figures. There is also an initial improvement in the reports of Types III, V, and VII,—the mixed types, viz., numerals and letters; numerals, letters, and words; and the "tit-tat-to" combinations,—which persisted through *Test Series C*, but which was followed by an abrupt decline in *Series D*. Since no introspections were taken we are unable to account for this difference. The uniformity, however, of the improvement of the pure types, and the decline of the mixed types, indicates that this difference may be due to the complexity of the material and the diversity of the associations aroused.

The table also shows the average number of elements of each type which can be grasped in a 5-second exposure. Before the practice, the number ranges from 3.16 to 4.93; after the practice from 3.87 to 6.20. The largest gains are made in the "pure" types; for example: in Type I *Test Series D* 6.20 elements are apprehended, a gain of 1.27; inType III 5.02 elements are apprehended, a gain of only 0.27. The average gain in the pure types is 0.80, of the "mixed" types 0.12 elements.

e. Retention of Practice: *Test Series E* was submitted after an interval of 36 weeks in order to discover whether the effects of practice were permanent. Fortunately all but three of our subjects were able to serve in the re-test, and their results appear in detail in Table I. The average results and mean variations are shown for every class in Table VII.

Though all the classes show a loss there is surprisingly little difference between the results of this test and those of *Test Series D*. The net loss is slight, amounting, as shown in Table VIII, to only a little over 1 unit. This is principally due to the reports of the poorest third of the class and to the boys. The individual records, however, are very much superior to those made a year previously (before the drill), hence we may conclude that the effects of practice are relatively permanent.

2. SPECIAL POINTS:

a. The Effect of the Practice upon Mental Age: The children were re-examined at the conclusion of the Drill Series with the Yerkes-Bridges test in order to learn whether practice in visual apprehension had effected their mental status. The results of this re-test appear in detail in the fourth and fifth columns of Table I.

An inspection of these data reveals the fact that the subjects, with but two exceptions, make a higher record in the second than in the first examination. Don, in Class I, shows a loss of 0.42 years; and Freddie, in Class III, shows no change. The amount of improvement is more clearly shown in the gross class and group averages which appear below:

TABLE X

Results of Mental Examinations by the Point Scale of the Practiced and Unpracticed Groups

		Practiced Group				Unpracticed Group			
		First test		Second test		First test		Second test	
		Before practice		After practice					
Class		Mental age	C. I. A.	Mental age	C. I. A.	Mental age	C. I. A.	Mental age	C. I. A.
I	Av.	9.68	0.730	10.39	0.790				
	m. v.	0.76	0.069	0.92	0.064				
II	Av.	8.69	0.610	9.63	0.720				
	m. v.	0.40	0.065	0.90	0.067				
III	Av.	8.17	0.552	8.64	0.608				
	m. v.	0.33	0.045	0.49	0.065				
Total	Av.	8.86	0.637	9.57	0.710	9.14	0.644	9.28	0.650
	m. v.	0.67	0.085	0.99	0.095	0.96	0.099	0.82	0.086
Girls	Av.	9.21	0.652	10.24	0.741	9.08	0.620	9.24	0.650
	m. v.	0.82	0.098	0.093	0.090	1.23	0.126	0.95	0.090
Boys	Av.	8.59	0.626	9.05	0.684	9.19	0.664	9.32	0.668
	m. v.	0.58	0.087	0.67	0.095	0.71	0.074	0.69	0.085

C. I. A., Coefficient of intellectual ability.

This table shows that the average gain is almost a year (0.71). It is most noticeable among those having the highest coefficient of intellectual ability. Classes I and II, and the girls have the highest coefficients, and they also show the greatest gain.

In order to ascertain whether this gain was due to an actual mental improvement, and not to the mere repetition of the tests, a group of 11 children, six girls and five boys, was used as a control. These subjects were tested and re-tested at the same times as were those of the main experiment. The results of their examinations appear

also in Table X, under the caption *Unpracticed Group*. These children show on an average a very slight gain in the re-test; a gain—0.14 of a year—which we should expect solely as a consequence of the increase in chronological age.[19] Since the control, the unpracticed subjects, show no effects of repetition, the mental improvement of the practiced observers can not be explained upon a basis of familiarity with the mental tests. Whether this improvement is due to the training in our drill in visual apprehension, and, if so, whether the transfer is specific or general, we can not here say. The improvement, as we have remarked above, is very uniform, and is so large that it can not be neglected. These results confirm those of our earlier experiment,[20] and strongly indicate a transfer of training.

b. Relation to Mental Age: The classification of the subjects into the good, medium, and poor,—Classes I, II, and III respectively,—agrees very closely with a similar division of mental ages shown by an inspection of the data in Tables IV and X. Table IV shows the average standing of each class in visual apprehension; Table X shows the average mental age in each class in the two Yerkes-Bridges examinations. A comparison of these tables reveals that the good observers, Class I, have the highest mental age; and the poor observers, Class III, the lowest mental age. Likewise, as regards sex, the girls make the higher score in our work and they test the older mentally.

These results would seem to indicate a closer correlation between ability in visual apprehension and mental age,—and such a correlation is found to exist. Two positive coefficients show this relation: the first, between the subjects' standing in the *Preliminary Practice Series* and the first mental test; the second, between the subjects' standing in the final series of the training, *Test Series D*, and the second mental test. The coefficients and probable errors, as obtained by Spearman's method of rank differences, are:

	Correlation	P. E.
1. Standing in visual apprehension and mental age, before practice	0.70	0.056
2. Standing in visual apprehension and mental age, after practice	0.63	0.094

[19]After an interval of 17 weeks (0.33 years) the group showed an improvement of only 0.14 year, which corroborates Yerkes's findings, "that the Point Scale appears to stand fairly satisfactorily this kind of test of reliability," (*A Point Scale for Measuring Mental Ability*, 1915, p. 102).

[20]Pp. 399–402.

c. The Effect of Practice upon Capacity to Observe: In order to discover whether the training was specific, whether our subjects had really become noticeably better observers, and whether there was a transfer in training, an *Aussage* test was given. As a check or control it was also given to the unpracticed group mentioned above.

These tests were conducted by D. G. Paterson, in June, 1916, immediately after the conclusion of the main experiment. He makes the following report:

"All the children, with the single exception of Walter R. of the practiced group, Class II, who was ill during this work, were individually subjected for 30 seconds to the Binet 'card of objects' test.[21] The reports of the two groups were compared first, with respect to the number of objects correctly recalled; and secondly, with respect to the number of answers correctly returned to an 'interrogatory' of 50 set questions.[22] The results show that the practiced group was not superior to the unpracticed in the number of objects correctly recalled; but was superior in the number of questions correctly answered. The data are given below in Table XI."

TABLE XI

Group Averages and Mean Variations in the Aussage Test

Groups	Classes	Objects Correctly Recalled		Questions Correctly Answered	
		Av.	m. v.	Av.	m. v.
Practiced	I	4.30	1.14	29.0	7.3
	II	4.17	1.33	26.9	3.6
	III	4.15	1.20	26.9	6.2
	Av.	4.20	0.38	27.4	5.8
	Girls	4.58	1.35	27.4	6.0
	Boys	3.90	1.00	27.4	5.9
Unpracticed	Girls	3.83	1.05	25.5	5.5
	Boys	4.60	0.48	26.5	5 1
	Av.	4.18	1.06	25.9	5 3

[21] *Cf.* Whipple, G. M., *Manual of Mental and Physical Tests*, 1st Ed., 1910. Test, 32, A, pp. 297–301.

[22] *Cf.* Whipple, G. M., *Ibid.*, 298–299.

The superiority of the practiced group in the number of objects correctly reported is very slight, and of no particular significance being probably a chance variation, for the difference is only 0.02, with a probable correctness of only 0.55.[23]

The difference in the number of questions correctly answered, was, however, more marked. The average score of the practiced group was 27.4; that of the unpracticed group 25.9. The difference, 1.5, has a probable correctness of 0.77, and is therefore not likely of chance occurrence. Still, we hesitate to conclude that this is due to training in our sort of work, for a comparison of Tables X and XI reveals that the capacity to observe is, as shown above in the preceding section, closely correlated with mental age: the practiced group is mentally older than the unpracticed group; Class I gives the best reports and is the oldest mentally; Class III gives the poorest reports and is the youngest mentally; the girls, in the practiced group, give better reports and are older mentally than the boys; and the boys, in the unpracticed group, give better reports and are older mentally than the girls.

Were it not for the results of Class III we should be satisfied to conclude that the difference in the capacity to observe is due to a difference in mental age, and that there is no evidence of a transfer of training. Class III is mentally over half a year younger than the control group and yet gives better reports in the *Aussage* tests. The differences and the probable correctnesses are small, and may be regarded as chance variations. Nevertheless, the results point to a transfer of training, for we still have to explain why the records of this group equal those of the control group, when according to mental age we should expect them to be inferior. It may be, and we offer this merely as a tentative explanation, that the reports in the *Aussage* test are conditioned both by practice and by mental age; and that the effects of the former are obscured by the latter in all the groups except Class III.

d. Comparison with Adults: In the comparison of the range of visual apprehension of practiced feebleminded children with adults, one of the most difficult sections of *Drill Series 3*, one in which there were 100 elements, was given to an elementary class in psychology at Ohio State University. There were 94 students in the class, composed mostly of freshmen, 28 women, and 66 men. The data thus obtained were graded according to the method described above,

[23]Calculated according to the formula of E. G. Boring: *On the Computation of the Probable Correctness of Differences, Am. J. of Psy.*, XXVIII, 1917, pp. 454–459.

and the students were then divided upon a basis of these grades into three groups, the good, the medium, and the poor, Classes I. II, and III, respectively. The average record of each of these classes, the total average, and the average according to sex, appears in comparison with similar records of the children in Table XII.

TABLE XII

Comparison of the Range of Visual Apprehension of the Feebleminded Children and the Adults

Class	Feebleminded Subjects		University Students	
	Av.	m. v.	Av.	m. v.
I	55.8	4.0	67.3	2.7
II	45.3	1.9	59.1	1.5
III	35.9	3.9	50.7	2.9
Total	45.47	7.21	58.84	4.64
Girls	48.7	8.2	56.1	5.6
Boys	43.0	6.3	60.0	5.6

These results show that the adults are on the average better observers than feebleminded children, even though the children have had four months of special training. It is also worthy of note that the feebleminded children of Class I excel the adults of Class III; that is to say, the upper third of a group of feebleminded children give better reports than the lower third of a class of University students.

e. Dependence upon Chronological Age and Sex: Though the general results of practice were identical for the different ages and sex, the range of visual apprehension varies with chronological age and with sex.

The correspondence with chronological age, however, was not absolute. This is shown by the results of Table XII, and by a comparison of the results of Table III and IV. The adults, whose average ages were 19.3, give better records than the feebleminded subjects whose ages averaged 14.6; the girls, whose chronological ages averaged 15.59 give better reports than the boys whose chronological ages averaged 13.03; and Class II, the group of medium observers, was chronologically older than Class III, the group of poor observers. Here, however, the correlation between chronolog-

ical age and performance in the tests of visual apprehension ends; for Class I, composed of the best group of observers, is chronologically the youngest,—yet withal, it is the oldest mentally. Since it is the oldest mentally, and since the other groups which we have mentioned above as excelling are likewise the oldest mentally, we must conclude that the range of visual apprehension is correlated with chronological age only in so far as it is a condition of mental age.

Under the conditions of this experiment the girls were better observers than the boys. The results leading to this statement are quite uniform: the girls records are superior to those of the boys in the *Drill Series* (Table IV), in the *Test Series* (Table VI), in the amount of the practice gain (Table VIII), in the retention of the effects of practice (Tables VI and VIII), and in the degree of variability as shown by the mean variations in Tables IV and VI. This superiority, however, we do not believe to be on account of a sex difference, but in spite of one. The influence of sex, we think, is observed by other factors. The girls are chronologically 2.56 years, and mentally 1.19 years older than the boys, and both of these factors, as we have shown above, condition the range of visual apprehension; and we believe, therefore, that they are responsible in the present instance for the girls' superiority. In our earlier work[22] exactly contrary sex results were obtained; the boys in the normal group were superior to the girls, and the men in the adult experiments (those reported above and those reported in our earlier work),[23] were superior to the women. Class I of the present adult experiment is composed of 7 women and 24 men, Class II of 6 women and 25 men and Class III of 15 women and 17 men. When the members of this group are arranged in order of rank, there is not a woman among the first 11. So with the feebleminded. The male superiority is shown by the fact that when subjects of the same average mental age are chosen and their records compared, those of the boys are slightly greater than those of the girls. Therefore we conclude, that men and boys of the same mental status are slightly superior in visual apprehension to women and girls.

f. Individual Differences: The individual differences in the capacity for visual apprehension are large, as is clearly indicated by Table I. Some of our subjects are very efficient, even excelling adults; others very poor. The range of the reports extends, in the *Preliminary Practice Series*, from 57.5 to 19.5; in the *Drill Series*,

[22]Pp., 395 f. [23]Pp., 394 f.

from 69.5 to 19.0; and in the *Test Series*, from 59.3 to 18.5. These differences, however, offer no particular problem, for they may be satisfactorially explained upon a basis of mental age.

g. Variability: The degree of variability in visual apprehension as expressed by the m. v. is shown for the three classes, for the total, and for the girls and boys, in Tables IV, V, VI, VII, and XII. Table XII shows that the adults have a smaller m. v. than the children; Tables IV and VI show that of the feebleminded group, the girls have a smaller m. v. than the boys, and that Class I has on an average the smallest m. v. and Class III the largest; and Tables V and VII show that of the normal group the boys have a smaller m. v. than the girls. Since the adults are mentally older than the children, the feebleminded girls than the feebleminded boys, Class I, than either Class II or III, Class II than Class III, and the normal boys, than the normal girls,[24] we conclude that the degree of variability is conditioned by and varies inversely as the mental age.

A comparison of Tables IV and V, and Tables VI and VII, however, reveals that the feebleminded children, who are mentally older than the normal children (Table III) have of the two groups the larger m. v. This seems to be in direct contradiction to the conclusion drawn above. In reality, however, it is not; it is rather the result of a second condition which in this instance cuts across and obscures the condition of mental age. The effect of this second condition is also shown in Table X where it appears that Class III, which had the largest m. v., had also the smallest coefficient of intellectual ability; and Class I, which had the smallest m. v., had the largest coefficient. Since the abnormal have a larger m. v. than the normal, and the subjects with a low coefficient than those with a high coefficient, we conclude that the extent of variability is conditioned by and varies directly as the degree of abnormality.

The conditions, then, that effect variability are mental age and abnormality. These two conditions may augment the variability, as in the case of the several classes; or the effects of the former may be obscured by those of the latter, as in the case of the normal and abnormal subjects.

[24]As we have said before, the normal children unfortunately were not given a mental test. We came to the conclusion that the boys were mentally older than the girls because their records in the practice and tests of visual apprehension surpassed those of the girls. Since we found, as shown above, that performance in visual apprehension is directly correlated with mental age, it follows that the boys were, in fact, mentally older than the girls.

h. Weekly Rhythm: The average of the reports in the *Test Series* was computed for each day of the week. Little evidence was obtained for weekly rhythm. It was found that the average range of visual apprehension in a 5-second exposure, was 4.11 on Monday, 4.10 on Tuesday, 4.16 on Wednesday, 3.99 on Thursday, and 4.10 on Friday. There is a slight drop in the subjects' capacity on Thursday which we are unable to explain, but the significance of the difference is so small that it is due probably to a chance variation.

III. SUMMARY

The general results of this study may be summarized as follows:

(1) The effect of practice in visual apprehension in the backward and feebleminded children is characterized by a slow and gradual improvement; conversely such an improvement in visual apprehension is indicative of backwardness.

(2) The range of visual apprehension varies with the complexity of the material and the diversity of the associations aroused.

(3) The effect of the practice is relatively permanent.

(4) The subjects' improvement in mental age, and their superiority in their capacity of general observation is evidence for a restricted belief in formal discipline.

(5) There is a direct correlation between the range of visual apprehension and mental age.

(6) Adults, university students, tested without special practice, are superior to trained feebleminded subjects, though the lower third of the adults are then inferior to the upper third of the feebleminded.

(7) The range of visual apprehension is correlated with chronological age, only in so far as chronological age is a condition of mental age.

(8) When subjects of the same mental age, or status, are compared, men and boys are slightly superior to women and girls.

(9) Individual differences are marked, but they are closely correlated with mental age.

(10) The extent of variability is conditioned by mental age and degree of abnormality, varying inversely with the former and directly with the latter.

THE ABILITIES OF PUPILS IN DETROIT PREVOCATIONAL CLASSES

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The prevocational classes in the City of Detroit were formed for the purpose of providing instruction and training for pupils who have been "unable to profit by the instruction in the ordinary public elementary schools" and who have spent some time in a special class or ungraded room and have now reached the adolescent years. The immanence of their reaching the upper age limit of the compulsory education law forcibly presents new problems for those whose duty it is to do all that can be done, in a scholastic way, for these atypical children. The seven prevocational classes were instituted to add, in a last Herculean effort, whatever possible to make these pupils more nearly conformable socially and to help them to attain the ultimate limits of their capacities. There are five such classes for boys, and two for girls.

The purpose of this investigation was to collect information which might throw some light on such questions as "How nearly, with present curricula and methodologies, do these classes fulfill their mission?" "With pupils of this intellectual calibre is it profitable to continue the present traditional admixture of manual training, industrial arts and academic subjects (geography, reading, language, arithmetic, spelling, etc.)?" "Are these classes affording a type of instruction that, with pupils such as these, will function in a truly prevocational way?" "Are the efforts expended here producing results in turning these children out at sixteen better fitted to become self-sustaining citizens?" Or, "Are they merely marking time, with these subjects serving as busy-work, until they pass beyond the school age and the burden of responsibility for the pupils is shifted to other shoulders?" The only satisfactory means of approaching these questions and a legion of others that obtrude upon the minds of those whose business it is to administer such

schools is to determine the specific abilities and disabilities of the subjects who are receiving this course of training and instruction. Provision for the studies reported here were made by Mr. Fred. L. Keeler, Superintendent of Public Instruction, Lansing, Michigan, and Mr. Frank Cody, Assistant Superintendent of Schools, Detroit.

THE SUBJECTS

The subjects comprised about 300 pupils in the five boys' classes, Nichols, Cary, Russell, Goldberg and Newberry, and the two girls' classes, Lincoln and Craft. This number is probably too low and does not include all pupils of this age and status in the city. The total school population is 97,740. Grade-age reports from the department of statistics show that 5.3% of these 97,740 pupils are 3 years or more retarded. At present there are 35 special classes in all, enrolling 738 different pupils, averaging about 22 per class. Instead, assuming that 2% of the total school population are of this level, it would mean there should be not less than 1954 pupils in these special classes. It would take 74 such classes of 25 pupils each to accommodate this number, which would mean the establishment of 39 additional classes, of which at least one third would have to be prevocational classes. *Cleveland, Ohio, of slightly smaller population, had in 1915 one hundred and forty special classes and enrolled 2,559 pupils.

The chronological ages of the pupils ranged from twelve and one-half to seventeen, with the median age at about fourteen and one-half. The number present in each of our studies was not constant, for various reasons. The number varied from about 264 to 308.

THE TESTS

It was decided to ascertain the level of general intelligence of these pupils, their linguistic ability, their ability to read silently, and to deal with numbers. We secured ratings of each with the Stanford Revision of the Binet scale, Trabue Completion Test Language Scales B and D, (D, of equal weight and difficulty, being used as a check) the Kansas Silent Reading Test (Kelly's Group 1) and Starch's Arithmetical Scale A (Reasoning). We assumed that these quantifications would afford a reasonably justifiable description of intellectual and pedagogical equipments. The latter three

*DAVID MITCHELL. *Schools and Classes for Exceptional Children.* Cleveland Survey Report.

tests were given by the regular class teachers after instruction and training. All scoring and tabulating of results was done by the writer. The Stanford Revision was given to each pupil during the course of the school year by Misses Alice B. Metzner and Anna Engel, the mental examiners for the board of education of the City of Detroit.

Trabue's Completion Test Language Scales were selected as measures of the ability to use and control the mother tongue because of their facility in scoring and their high correlation with general intelligence. *Thorndike, Stenquist and Trabue found this to be .875 with the Goddard 1911 Revision with about 150 dependent subjects in ages 10 to 14. In our cases a random sampling showed a Spearman "r" to be .92 with the Stanford Revision ratings. A glance at Table X shows how closely the percentiles approximate in each age year. Scale B was followed about 3 weeks later with scale D as a check and to determine the nature and extent of any practice effect. A comparison of the distribution in Table IV shows this to be a practically negligible factor in the case of these pupils—a fact not without its significance.

Since the ability to read silently with speed and comprehension is the one *sine qua non* in most school subjects we decided to use Kelly's Kansas Silent Reading Tests—Series 1—as the measure of this ability. The question as to whether these tests are only examples of problem solving in arithmetic, hard-directions tests, or whether they elicit performances from which abilities are inferred is irrelevant to our problem. Subnormals give quite a distinctive type of performance with this test and some interesting side-lights on the mental make-up of these pupils are revealed, as our results show. The tests were new to the pupils and were given in the regular reading exercise period. The same is also true of the measures of language and arithmetic.

Because of its simplicity in scoring and the allowance of plenty of time (30 to 45 minutes) and because it involves not only the fundamental operations but also the solution of many practical examples, we selected Starch's Arithmetical Scale A (Reasoning) for the work with numbers. His June standards were employed in evaluating results. It might be added that there was very little uniformity

*Psychological Clinic, Vol. X, No. 5.

in the amount of time, methods of presentation or stress upon arithmetic in the seven classes. In some of the schools twice as much time was devoted to certain subjects as in others.

RESULTS

Intelligence Status of the 308 Pupils

The following table shows the ratings of the 308 pupils in these classes. The number rating

I. Q.,	Diagnosed as—	% of total cases
.70 – .90	Backward	38.94
.50 – .70	Feebleminded	54.21
.20 – .50	Idiot-Imbecile	3.56
		96.71

But 6.81 per cent. of these cases rate between I. Q. .80 and .92. Practicaliy the only ones from whom anything like useful independdent citizenship can be expected must be drawn from this small per cent. of the total group. As will be shown later but about 12 per cent. make scores equal or in excess of the level of the normal 5th grade child in the language completion tests, in arithmetic but about 2 per cent., and in silent reading this number is less than 1 per cent. of the whole number. Sixty-three per cent. of all these pupils have an I. Q. below .70.

Tables II and III show the distribution of the chronological and mental ages. Eighty-nine per cent. of the cases lie in mental ages VIII, IX and X, while the median chronological age is a few months in excess of fourteen years. Tables I, II, and III show the numerical distributions by classes. The 5 boys' classes enroll about

TABLE I

Numerical Distribution of Intelligence Quotients

	.25 to .40	.40 to .49	.50 to .59	.60 to .69	.70 to .75	.76 to .79	.80 to .92	Total
Nichols	0	0	2	15	12	7	6	42
Craft	0	1	7	23	11	3	2	47
Goldberg	0	1	5	7	18	2	4	37
Russell	1	1	10	22	11	5	0	50
Lincoln	1	4	11	17	7	0	1	41
Cary	0	0	6	26	7	4	7	50
Newberry	0	2	7	19	12	0	1	41
Total	2	9	48	129	78	21	21	308

TABLE II

Chronological Ages

	XII	XIII	XIV	XV	XVI	XVII
Nichols....	0	10	19	12	4	0
Goldberg...	1	4	10	10	2	1
Newberry...	0	2	19	8	3	0
Craft.....	0	6	14	18	5	0
Russell.....	2	6	13	16	1	0
Cary.....	0	8	13	13	1	0
Lincoln.....	0	5	14	14	3	1
Total..	3	41	102	91	19	2

TABLE III

Numerical Distribution of Mental-Ages

M. A.....	5	6	7	8	9	10	11	12	13	14	15	No. Cases
Newberry.....	1	1	6	11	17	5	0	0	0	0	0	41
Cary.....	0	0	3	10	18	11	5	0	1	1	1	50
Lincoln.....	0	2	6	14	12	4	0	0	0	0	0	38
Russell.....	1	0	4	15	16	7	2	0	0	0	0	45
Goldberg.....	0	0	4	6	11	11	5	0	0	0	0	37
Craft.....	0	1	3	12	17	7	3	0	1	0	0	44
Nichols.....	0	1	3	12	19	12	4	1	0	0	0	52
Total.....	2	5	29	80	110	57	19	1	2	1	1	307

Median Mental Age.... 9.3 years
Median Chron. Age.....14.5 years (approx.)

180, and the 2 girls' classes about 90. Whether this supports the view that girls are more "pure line"—that they deviate less than boys—cannot be said. It may be due to the mode of selection, or differences of criteria, or to other factors.

TABLE IV

Distribution of Scores—Trabue Completion Language Scale B

Scores...	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	Median
Russell.....	4	0	3	1	3	4	5	1	3	0	2	4	2	4	0	0	6 60
Craft.....	0	0	4	0	2	2	16	2	9	5	2	0	1	0	0	0	6.84
Nichols.....	0	0	0	0	0	3	3	1	6	8	13	2	2	4	3	0	10.12
Newberry...	1	0	1	0	10	1	7	4	6	1	2	2	0	0	0	0	6.64
Goldberg....	2	0	1	0	5	0	7	2	4	3	3	1	0	0	0	0	6.85
Cary.....	2	0	2	1	3	1	0	7	8	2	5	3	0	1	0	1	8.33
Lincoln.....	6	0	1	1	9	0	10	2	3	3	0	0	2	0	0	0	6.15
Total...	15	0	12	3	32	11	48	19	39	22	27	12	7	9	3	1	7.21
Scale D Total ..	21	1	22	8	32	7	28	24	37	11	24	16	8	4	4	0	7.25

TABLE V

Quartile, Median and Upper and Lower Quartile Scores, Trabue Scale B

	Lin.	Russ.	New.	Craft.	Gold'g	Cary.	Ni.
75 percentile....	7 37	11.25	8.37	8.69	8.99	10.20	10.98
Median.....	6.15	6.60	6.65	6.84	6.85	8.32	10.12
25 percentile....	4.13	4.33	4.60	6.10	4 80	5.99	8.70
Quartile.....	1.62	3.46	1 88	1.29	2.09	2.10	1.14

TABLE VI

Languages Spoken in the Homes of Pupils in Six of the Seven Schools

	New.	Cary.	Gold'g	Lin.	Russ.	Craft.	Total
English	18	34	24	9	14	20	119
English and Foreign	5	9	1	9	10	9	43
Polish	7	3	3	2	7	10	32
German	7	0	0	2	0	2	11
Russian	2	0	0	0	0	0	2
Bohemian	1	0	0	0	0	1	2
Hungarian	0	2	0	1	0	0	3
Italian	0	0	1	6	5	0	12
Jewish	0	0	3	6	12	0	21
Russian-Jewish	0	0	0	10	0	0	10
Austrian	0	0	0	1	0	0	1
Lithuanian	0	0	2	2	0	0	4
Syrian	0	0	0	1	1	0	2
French	0	2	0	0	0	0	2
Norwegian	0	0	1	0	0	0	1
Finnish	0	0	1	0	0	0	1
Deaf-Mute	0	0	1	0	0	0	1
Total	40	50	37	49	49	42	267

Tables IV, V and VI show the results of the Trabue scales. Here the Nichols pupils stand distinctly superior in abilities to the other groups. Nichols is a "favored" school in a better residential section and this may account in part for the superiority. Table VI shows the languages spoken in the homes of these pupils. Records of the Nichols group are not included as they were not available. The data were secured by the teachers in visits to the homes. In 56 per cent. of the homes some tongue other than English is the vernacular. There is a large foreign population in Detroit. What influence this has on the performances of these pupils in educational measurements it is difficult to say. Most of the pupils, however, have spent at least 5 years in American schools. Seventy-five per cent. of all the pupils rate below the normal III grade level in these tests. The lower quartile group rate even below the median of the normal second grade. A few cases show abilities as high as those found in high school classes. The medians of the two girls' classes stand considerably below the boys' medians.

In arithmetical ability (see Tables VIII and IX) fully 80 per cent. of all cases lie below the normal V grade level. One hundred twenty-four of the 270 pupils taking this test rated below or equal to the normal III grade standard. The best group, Nichols, are about twice as capable in arithmetic as the poorest group, Lincoln. Miss Merrill[1] concludes from her testing Minnesota defectives with the Courtis B tests "The fundamental operations can only be taught with profit in the case of high grade morons and in a few instances with mid-grades."

TABLE VII

Numerical Distribution of Scores—Kansas Silent Reading, Test 1

Scores.	0	1.2 to 4.0	4.2 to 5.3	5.8 to 9.3	9.9 to 13.2	15.7
Nichols....	15	13	4	5	0	0
Craft.....	10	6	3	6	1	1
Lincoln.. ..	13	16	3	3	1	0
Newberry...	18	20	3	2	0	0
Russell.. ..	14	13	5	4	1	0
Cary.....	15	13	6	3	3	0
Goldberg..	8	12	6	1	1	0
Total..	93	93	30	24	7	1
	III Grade Level (5.3)		IV Grade Level (9.3)		V Grade Level (13.2)	

[1]MERRILL, MAUDE A., *Abilities of Special Class Children in the 3 R's*, Ped. Sem., XXV, 88-96.

In ability to read silently, as measured by this scale, of these pupils,

86% (216) fall below the III Grade Level.
14% (35) stand above III Grade Level.

Of this 14%—

5 pupils = III Grade, or 1.96% of all cases.
22 pupils = IV Grade, or 8.82% of all cases.
7 pupils = V Grade, or 2.80% of all cases.
1 pupil = VI Grade, or 0.42% of all cases.

TABLE VIII

Distribution of Scores—Starch's Arithmetical Scale A

Step	0	1	4	6	7	8	9	10	11	12	13	14	15	
Value....	0	.4	3.8	5.9	6.7	7.7	9.2	10.3	11.3	11.7	12.9	14.2	15.1	
Nichols.....	0	1	2	5	5	10	10	4	1	0	0	0	0	
Goldberg.....	4	2	3	8	5	6	3	1	1	0	0	0	0	
Russell.....	4	6	11	6	10	2	4	0	0	0	0	0	0	
Newberry.....	3	3	4	11	5	8	5	1	0	1	0	0	0	
Craft.....	1	5	13	8	7	5	0	1	0	0	0	0	0	
Cary	3	3	11	8	7	2	1	0	0	0	0	0	0	
Lincoln.....	5	12	8	7	4	3	0	1	0	0	0	0	0	
Total.....	20	32	52	53	43	36	23	8	2	1	0	0	0	—270

Standard June Scores

Grade.....	3	4	5	6	7	8
Score.....	4.5	6 2	7.8	9.4	11.0	12.6

TABLE IX

Median Scores in Arithmetical Scale

Nichols.....	8.60
Goldberg.....	6.65
Russell.....	6.62
Newberry.....	6 56
Craft.....	6.00
Cary.....	5.95
Lincoln.....	4.55

TABLE X

80% of the Total 270 Pupils are Distributed in Mental Ages VIII, IX and X. The Following Table Presents Percentages of Pupils Who in the Tests Actually Attained Age and Grade Scores Equivocal to Expectations from their Mental Ages

M. A.....	VIII	IX	X	Total %	% Below III Grade	% Above V Grade
Grade.....	III	IV	V			
Arithmetic.....	18.0	29.0	11.0	68	30	2
Silent Reading.....	1.9	8.8	2.8	13.5	86	0.5
Language.....	25.5	24.0	10.3	59.8	26.9	13.3
Total M. A. percents. at this age.....	26.6	36.6	19 0	= 82.2% of all cases.		

Table VII shows the performances of these pupils with the Kansas Silent Reading Tests. Lack of ability to comprehend word meanings and to follow simple directions seems to be one of the principal defects of these pupils. Eighty-six per cent. lie below the normal III grade level in this respect. But 24 attain the IV grade standard and only 7 reach the V grade standard. Weidensall,[1] in a similar way, says of her Bedford Hills subjects "a simple idea, a direction, a perception, does not penetrate and lead out into successful execution for any save the better third of our subjects . . . . . " in her modification of the Woolley Cincinnati working girl vocational tests.[2] Table X represents the age and grade levels of attainment at the various mental ages. In a sort of stereotyped way these pupils are able to do the mechanical operations in arithmetic, that is to say they may be trained to multiply, add, subtract and divide. They are hardly educable with numbers. Where processes of abstraction and generalization are indicated it is a well known fact that these pupils are almost wholly unable to do anything worthy of mention with such exercises. For instance, at the Vineland Training school John is asked "Suppose you fed 6 ears of corn to your horses"—at which John interrupts "But we don't feed them 6 ears." "But just supposing you fed them 6 ears." "We never give 'em 6 ears, though." He

[1]WEIDENSALL, JEAN, *The Mentality of the Criminal Woman*, Educational Psychology Monographs, No. 14.

[2]WOOLLEY AND FISCHER, *Mental and Physical Measurements of Working Children*, Psy. Rev. Mon. XVIII, I, Whole No. 77.

was then asked "Suppose you took twelve ears of corn and fed them ten, how many would you bring back?" The answer was "Two." "How many are 12 less 10?" The reply was "Oh, I don't know that many." With pupils in whom there is such lack of insight, such marked deficiency in abilities of abstraction and generalization, in the perception of symbolized relations, and in comprehension of word meanings beyond the simplest nominal and verbal designations, how are we to expect them to be other than parties to a very uneconomical educational scheme at $125 per capita per annum?

What becomes of these pupils one, three, ten years after they leave school? Unfortunately there have been few investigations to follow them up. Pintner and Toops[1] in their studies of the abilities of unemployed men in the Free Employment agencies of Columbus and Dayton, Ohio, found 82 per cent. of the 94 men seeking employment as non-skilled laborers rated backward, border-cases or definitely feeble-minded. A comparison group in the two workhouses of these cities showed approximately the same distribution. Recent studies have shown that a great many recidivists in Sing Sing never had a trade—a steady job. It would seem then that the public schools could do a great deal if, rather than try to do the impossible with "academic" subjects, each of these pupils could be taught or trained to do some one thing with creditable skill, provided there were no indigenous limitations to prevent. There are reasons to believe, however, that much of the manual and industrial teaching in these classes is open to the same sort of criticism as the "academic" instruction. Along with Judd, in the case of the normal secondary schools, this "unfortunate dualism" of *manual* and *academic* could profitably be dispensed with. The somewhat common notion that all defectives can be trained to acquire a high degree of skill in the manual and industrial arts is not borne out in fact. It is just as reasonable to assume that all medical students, if given sufficient practice, can acquire a masterly surgical technique. That, however, is not the case. There is need for further studies of this problem. Again, it cannot be said that all "literary" instruction in these classes should be done away with. Just what type and how much are questions to be settled by careful and painstaking experimentation.

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[1]PINTNER AND TOOPS, *Mental Tests of the Unemployed* jr. *Appl. Psy. I, No. 4,* pp. 325 ff. II, pp. 15–25.

Summary and Conclusions

The justifiability of teaching "academic" subjects to *all* adolescent defectives in prevocational classes is to be questioned. If done at all, it can probably be done successfully only in the case of those who stand above the 90 percentile of this group.

Somewhat less than one child in every four can be said to be receiving practical benefit in a direct way from the instruction in reading, geography, language, arithmetic, etc.

Pupils of essentially the same mental age and I. Q. rating vary widely in linguistic, reading and arithmetical abilities. Hence the grouping of pupils of the same mental ages is not a reliable means of insuring proper educational treatment.

With abilities so variable, the handling of 30 to 50 pupils in the same instructional group forestalls individual instruction and defeats one of the aims of the special class. Likewise it is bound to entail great economic loss.

Only a very small per cent. of these pupils are intellectually capable of becoming independently self-sustaining. It is improbable that these and similar classes are truly *prevocational.*

Of the 308 cases 68 per cent. can do work in arithmetic comparable to children of the same mental age; 59.8 per cent. in language, and 13.5 per cent. in silent reading.

ENGLISH AND MATHEMATICAL ABILITIES OF A GROUP OF COLLEGE STUDENTS

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The following note presents the results of an attempt to determine to what extent "mathematical ability" and "English ability" are separate and measureable traits, in a group of college students.*

An introductory class in psychology made up of sophomores, juniors, and seniors (men and women), were asked to fill out cards stating whether they thought they had more ability in English or in mathematics. The reports were in the form "Much Greater," "Greater," "Slightly Greater," in either English or mathematics, or "Same." No definitions of the two abilities were given. Yet all but some half dozen of a class of 70 students could distinguish between the two sufficiently to be able to judge in which one they were better.

A week later the following 8 group tests were given.

Opposites.

39 stimulus words taken from the standardized list of King and Gold[1] varying from easy to hard. Time-limit 3 min. A credit of 3, 2, or 1 given to individual words.

Arithmetic.

A series of 13 problems mostly in subtraction, but a few involving addition, multiplication and division. All operations to be done mentally. Time-limit 3 min. A score of 1 for each correct answer.

Completion.

21 sentences taken from Trabue's[2] scales, varying from easy to hard. Time-limit 6 ½ min. A score of 1 given to each correctly filled blank.

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*Considerable evidence has already appeared suggesting the relative independence of these two abilities. Bronner (Augusta F. Bronner, "The Psychology of Special Abilities and Disabilities," Little Brown and Co., 1917) has presented striking instances among clinic children of special abilities and disabilities sometimes in the sphere of language and sometimes in that of number-work. Kelley (Truman L. Kelley, "Educational Guidance. An Experimental Study in the Analysis and Production of Ability of High School Pupils," Teachers' College Contributions to Education, No. 71, 1914.) has developed regression equations for prognosticating High School grades, which were different for English and mathematics.

[1]KING, I, AND GOLD, H. *Tentative Standardization of Certain Opposites Tests.* Journal of Educational Psychology, 1916. 7, 459–482.

[2]TRABUE, M. R. *Completion Test in Language Scales.* Teachers' College Contributions to Education, No. 77, 1916.

Algebra.

This test was originated by the writer. It is printed in full. Time-limit 3 min. Each correct answer given a score of 1.

For each of the following conditions state the relation of one letter to another as required in terms of equal to (=), greater than (>), or less than (<).

Example:

Given	State relation of	Answer
a=b; b=c	c to a	c=a

If you cannot do one problem pass on to the next. Work as rapidly as possible.

Given	State relation of	Answer
a>b; a<c	b to c	
c=b; b>k	c to k	
x+y=z; x>1; y=1	z to 2	
y=0; x+y=z	x to z	
a−b−c−d=0	c to a	
a+1=x; x+1=y	a to y	
a=b; b=c; c>d	d to a	
a<b; b<c; d>c	d to a	
a<c; b>c; b>d	d to a	
a−b=1; b−c=d	d to a	

Rhymes.

20 2-syllable words, alternately accented on the first and on the second syllables, as follows: precede, ample, delay, pencil, delight, weather, destroy, mixture, affair, wagon, assess, nourish, arrange, butter, defend, churlish, review, hardy, commit, kettle. A rhyming word to be found for each. Time-limit 1 ½ min. Each correct rhyme scored 1.

Generalization.

One of the Courtis Geometry Tests.[1] The common element to be picked out in each of 10 sets of 5 words.

Illustrations

Set A. Mental, method, matter, muscle, mother.
Answer: All the words begin with the letter m.

Set B. Washington, Lincoln, Taft, Wilson, Jefferson.
Answer: All the words are names of Presidents of the United States.

Time-limit 2⅓ min. Each correct answer scored 1.

Sentences.

8 short sentences,* the words arranged in a meaningless order, to be re-arranged to make sense. Time-limit 2¼ min. A score of 1 for each sentence correctly written.

*Three of the eight sentences were those given in the Binet scale.

Problems.

12 practical problems involving arithmetic to be solved mentally. Time-limit 4 min. A score of 1 for each correct solution.

[1]Courtis Standard Research Tests. Series G. Form 1. Test No. 4. S. A. Courtis, Detroit, Mich.

The opposites, completion, rhymes, and sentences tests were supposed to be "English," the arithmetic, algebra, generalizations, and problems tests, "Mathematics."

The results were not computed for the half-dozen or so subjects who had reported "Same" ability for mathematics and English or for those who followed directions imperfectly. This left as the total number who took the tests and for whom the results were computed, 43. Of these 27 (2 men and 25 women) had judged themselves better in English and 16 (7 men and 9 women) better in mathematics.

The ogives, Figs. 1 to 8,[2] for each of the 8 tests and for the two groups, those who thought themselves better in English and those who thought themselves better in mathematics, have been drawn separately. Of the 4 supposedly English tests, the rhymes and sentences tests were apparently the most successful, the completion test somewhat less so, and the opposites test not at all. Of the 4 supposedly mathematics tests, the arithmetic and algebra tests were decidedly successful, the problems test less so, and the generalization test not at all.

The results for the 6 most successful tests will be considered further. Their intercorrelations are given in Table I.

TABLE I

	Completion	Sentences	Rhymes	Problems	Arithmetic	Algebra
Completion						
Sentences	.04					
Rhymes	.39	.13				
Problems	.36	.42	.03			
Arithmetic	.27	.16	.09	.34		
Algebra	.35	.15	.23	.33	.48	

The probable errors range from ±.10 for the correlation of .03, to ±.08 for that of .48.

Examining the table, the following points appear. The three mathematics tests correlate fairly well with one another, particularly the arithmetic and algebra tests (.48). In the case of the intercorrelation of the English tests, on the other hand, the only

[2]In all the charts the figures on the base line indicate the scores received in the test. The numbers in the vertical column to the left indicate the percentage of the group securing that particular grade or worse.

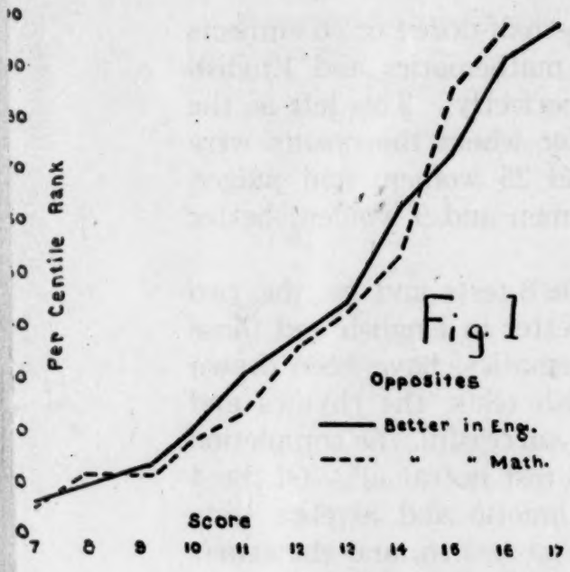

Fig. 1

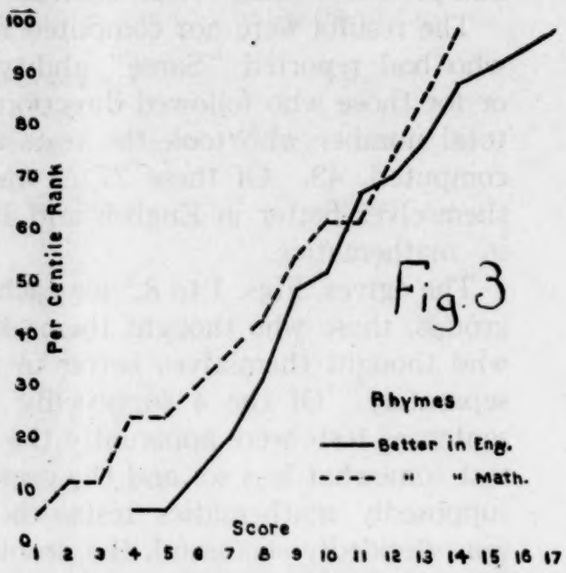

Fig. 3

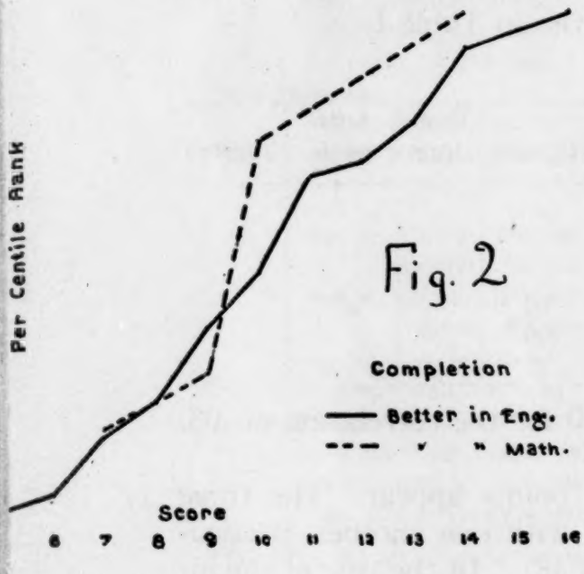

Fig. 2

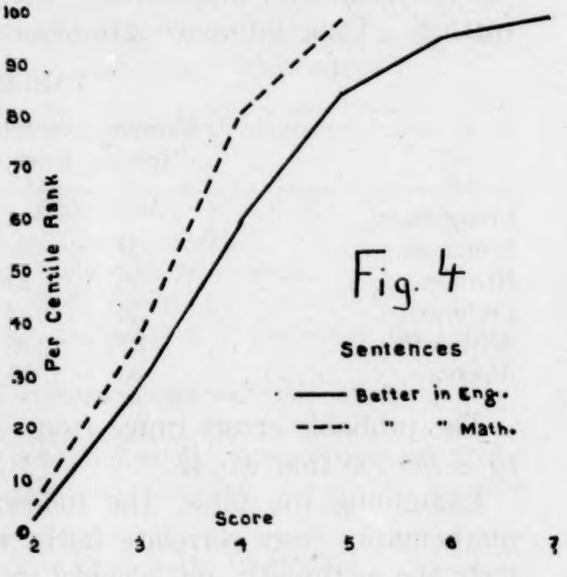

Fig. 4

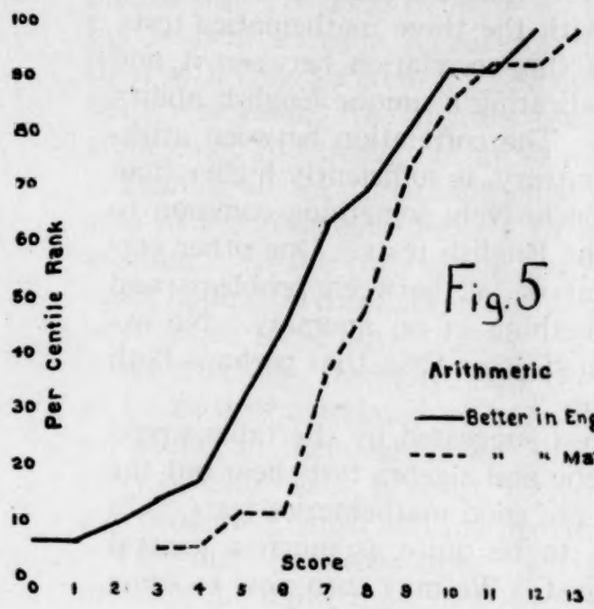

Fig. 5

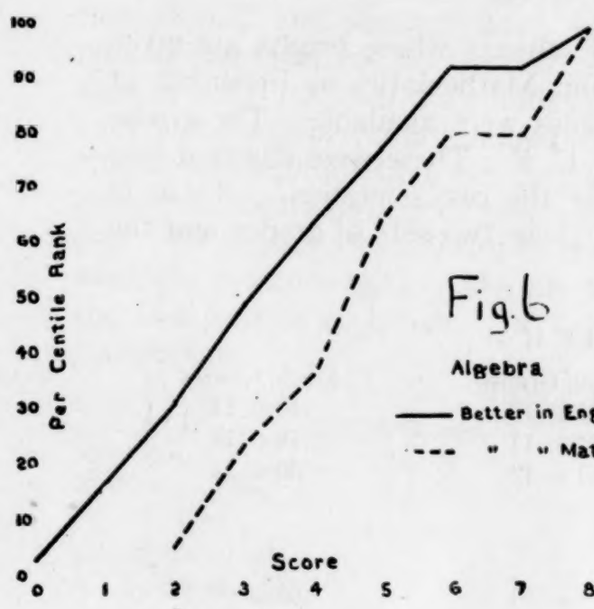

Fig. 6

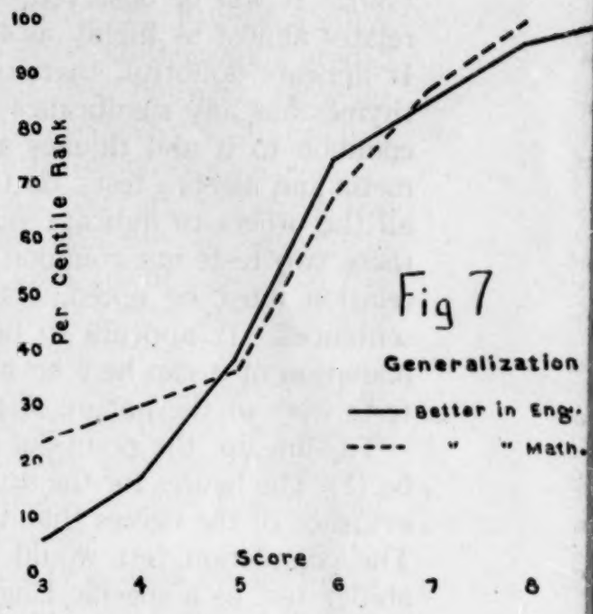

Fig 7

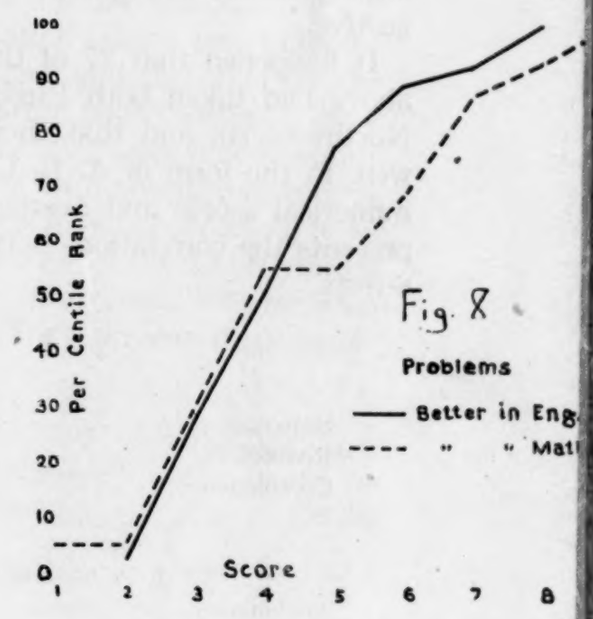

Fig. 8

coefficient of any size is that between the completion and the rhymes (.39). It will be observed, however, that the completion test correlates almost as highly as this with the three mathematics tests. It appears doubtful, therefore, if this correlation between it and rhymes has any significance as indicating a unique English ability common to it and rhymes alone. The correlation between arithmetic and algebra tests, on the contrary, is sufficiently higher than all the others to indicate very conclusively something common to these two tests not common to the English tests. One other correlation must be noted, viz., that of .42 between problems and sentences. It appears to be something of an anomaly. No explanation of it can here be suggested other than that perhaps both tests were of the nature of puzzles.

To sum up, the points of interest suggested by the table would be (1) The figures for the arithmetic and algebra tests bear out the evidence of the ogives that these are good mathematics tests. (2) The completion test would seem to be quite as much a general ability test as a specific English test. We may turn now to some other results we obtained which seem more interesting and suggestive.

It happened that 27 of the 43 subjects whose results are given above had taken both English and Mathematics as Freshmen at Northwestern, and that their grades were available. The grades were in the form of A, B, C, D, E, F. These were changed into numerical scores and averaged for the two semesters.[1] Table II presents the correlations between these two sets of grades and the 6 tests.

TABLE II

	English Grades	Math. Grades
Sentences	.27±.12	.10±.13
Rhymes	.41±.11	.14±.13
Completion	.21±.12	.36±.11
Arithmetic	−.02± 13	.57±.09
Algebra	.15±.13	.53±.09
Problems	−.12±.13	.14±.13

[1]In some cases the course had been dropped after a single semester, in which cases the grade for that semester alone had to be used.

Observing the three English tests, we again find that the completion test is of doubtful value for detecting specific English ability. For it here shows a higher correlation with mathematics grades than with English grades. The other two tests, however, show up better, especially the rhymes test. They correlate with English grades, and practically not at all with mathematics grades.

Turning to the three mathematics tests, the correlations in the case of the problems test are so small as probably to have little meaning. In the case of the arithmetic and algebra tests, on the other hand, the correlations with mathematics grades are decidedly high, while those with English grades are negligible.

We conclude, therefore, that the rhymes and sentences tests in so far as they correlated with the English grades, did so because of something in them which was not in English grades. These two pairs of tests seem, in short, to have brought to light specific and independent English and mathematics abilities.[1]

Two final questions arise. (1) Do the two tests of each pair measure the same thing, or has English ability two different phases, one of which is measured by the sentences test and the other by the rhymes test, and similarly has mathematics ability two different phases, one measured by the arithmetic test and the other by the algebra test? (2) Are the abilities which the tests measure merely a product of school training or are they something more fundamental? Neither of these questions can be answered with absolute certainty. Some considerations bearing on these points may be advanced, however. As regards the identity or non-identity of the factors measured, the evidence rests on the size of the intercorrelations between the two tests of each pair. In Table III we present these intercorrelations.

TABLE III

	English Grades		Math. Grades
Sentences	.27±.12	Arithmetic	.57±.09
Rhymes	.41±.11	Algebra	.53±.09
Correlation of sentences with rhymes	.17±.11	Correlation of Arithmetic with Algebra	.50±.10

[1]The two sets of grades (English and mathematics) have an intercorrelation of .47±.10, indicating, therefore that these grades are an expression not only of those specific English and mathematics abilities, but also to a very large extent of a common something which we may duh "grade-getting ability."

The appearance of these results suggests that the sentences and rhymes tests measure different and relatively independent phases of English ability, whereas the arithmetic and algebra tests measure the same phase or nearly the same phase of mathematics ability. But to be sure of these conclusions we must resort to partial correlation.[1] See Table IV.

TABLE IV

Total Correlations		Partial Correlations	
Sentences with Eng. Grades	$.27 \pm .12$	Sentences with Eng. Grades (Rhymes constant)	$.23 \pm .12$
Rhymes with Eng. Grades..	$.41 \pm .11$	Rhymes with Eng. Grades.. (Sentences constant)	$.39 \pm .11$
Arith. with Math. Grades...	$.57 \pm .09$	Arith. with Math. Grades... (Algebra constant)	$.42 \pm .11$
Algebra with Math. Grades	$.53 \pm .09$	Algebra with Math. Grades (Arith. constant)	$.34 \pm .12$

It will be observed that eliminating rhymes has practically no effect upon the correlation between sentences and English grades, and likewise that eliminating sentences has practically no effect upon that between rhymes and English grades. These two tests are, therefore, correlated with English grades by virtue of measuring different things. It would seem, in other words, that English ability has at least two different phases, one of which is approximated by the sentences test,[2] and the other by the rhymes test.

Turning now to the mathematics tests, we find that eliminating algebra does appreciably lower the correlation of arithmetic with mathematic grades, and similarly, that eliminating arithmetic appreciably lowers the correlation of algebra with mathematics grades. We conclude, therefore, that for each of these mathematics tests part of the high correlation between them and mathematics grades is due to an element which is common to both tests. It is to be noted, however, that this common element does not explain the whole of the correlations. Even after it has been eliminated, the arithmetic test shows a correlation with mathematics grades of .42 and algebra test one of .34. To sum up: The sentences and rhymes tests seem to measure things mutually exclusive, both of which, however, correlate in part with English grades. The arithmetic and algebra tests, on the other hand, measure in addition to two such mutually exclusive things, correlating with mathematics grades, another common something which also correlates with mathematics grades.

We turn now to the last question. Are the things measured merely a product of school training or are they something more

[1] YULE, G. U. *An Introduction to the Theory of Statistics.* London, 1912.

[2] The size of the probable errors is such as to render the value for the sentences not absolutely conclusive. It is of course unfortunate that we did not have more subjects. We shall assume, however, that increasing the number of subjects would have reduced the probable errors for the sentences test without materially affecting the relative size of its coefficients with English grades and with mathematics grades.

fundamental? In other words, how far are the correlations of our tests with the grades to be explained simply and solely because the things measured in the tests were the things actually taught in the courses leading to the grades, or how far are they to be explained by assuming that the tests measured something more fundamental, *i. e.,* innate or partially innate abilities upon which the school successes were themselves dependent? Comparing our four tests from that point of view, the probability would seem to be that success in the two English tests depended more upon innate abilities in this sense, and less upon formal school training than was the case in the two mathematics tests. Speed in getting rhymes and in mentally sorting groups of words to make coherent sentences obviously are not directly taught in either school or college. Mental arithmetic and the handling of algebraic symbols, on the other hand, are. The rhymes and sentences tests seem, therefore, to get at something more fundamental than the two mathematics tests. In connection with the latter, however, a further suggestion presents itself. May it not have been that that which was seen to be common to both tests and to mathematics grades was the effect of schooltraining; whereas the factors which were in each test independent of the other and remained in the partial correlations were of the nature of innate and fundamental abilities? Such a possibility offers a suggestion for further study.

Finally, before concluding, the rhymes test and the algebra test may be mentioned as of special interest; the former because it is so very simple and yet gave a correlation of .41 with English grades; and the latter because it seems new and depends for success, we believe, rather upon the ability to do a particular kind of mathematical reasoning than upon any practise in the use of the algebraic symbols as such.

In conclusion, the following points seem worth summing up: All but a small percentage of an unselected group of college students were able on a subjective basis to class themselves as better in either English or mathematics. The ogives from a number of simple tests chosen arbitrarily as either English tests or mathematics tests agreed with this classification. Furthermore, a pair of these tests, rhymes and sentences, was found which correlated with English grades but not with mathematics grades, and another pair, arithmetic and algebra, which showed just the opposite correlation. The two phases of English ability measured by the sentences and rhymes tests seem to be independent of one another. The two phases of mathematics ability, on the other hand, measured by the arithmetic and algebra tests were only in part independent. The rhymes and sentences tests probably did not measure formal school training at all, and the arithmetic and algebra tests probably depended for success only in part upon such formal training. The rhymes and algebra tests are worthy of further study.

COMMUNICATIONS AND DISCUSSIONS

VOCABULARY OF GRAMMAR GRADE SCHOOL CHILDREN

Considerable interest has been manifested in recent years in the study of vocabularies. It has been fairly well established that the writing vocabulary of the average eighth grade pupil is about 2100 words. The writing vocabulary of the average adult is 3200 words. What is the extent of the reading vocabulary of the grammar grade pupil?

With a view toward determining the extent of the reading vocabulary of grammar grade children by using an easily operated plan for approximating the vocabulary, a study of 125 children in grades five, six, seven and eight of the public schools of Charles City, Iowa, was undertaken by the writer. The pupils were equally distributed throughout the four grades, and well represented a random selection from the four hundred fifty children in the four grades of the city.

From Webster's Elementary School Dictionary one hundred words were selected at random. These words were given orally to the one hundred twenty five pupils. Each pupil was given an opportunity privately to give orally at least one definition of as many of the hundred words as he was able. He was credited with knowing the meaning of the word if he could give one of its meanings, or use the word correctly in a sentence.

After an interval of four weeks these words were given again. They were arranged on typewritten sheets and each pupil was given an opportunity to mark each word as known, unknown, or uncertain. All words marked uncertain were used in a sentence and credit was given for all correctly used. This test is referred to as the Checked Word Test.

A second type of written measurement was taken by arranging four definitions for each word, three of which were incorrect and one was correct. The pupils were asked to check under each word the correct definition. Both of the written tests were given to the pupils in groups of thirty. Sufficient time elapsed between each test so that none of the words were remembered and there was no indication that any pupil had taken the time to look up the definitions of any whose meaning was not recognized.

Table 1.

Table 1 shows the distribution of median number of words known from the one hundred.

Grade	V	VI	VII	VIII
In the Oral Test	43	53	62	72
In the Written Test	50	51	65	74
In the False Definition Test	50	58	63	72
Average of the three	46	54	63	73

Table I is read as follows: in grade V in the oral test the middle or median pupil knew 43 of the one hundred words; in the eighth grade 72 words were known by the median pupil.

Basing the determination of the size of the vocabulary upon the oral test, Table II shows the number of words in the reading vocabulary of the median pupil in each grade.

Table II

Grade	V	VI	VII	VIII
Vocabulary Index	43	53	62	72
Median, Age-Yrs.-Mo.	10-11	12-1	13-0	14-5
Median Vocabulary	14,448	17,808	20,830	24,192
First Quartile	12,768	14,448	17,808	21,504
Third Quartile	17,808	20,024	21,840	25,200
Quartile Deviation	2,520	2,788	2,016	1,844
Range from lowest	6,720	11,088	11,424	15,458
to highest	21,504	24,528	26,208	27,216

Table II is read as follows: in the oral test the record of the middle pupil in the fifth grade, age 10 yrs and 11 months, is a reading vocabulary of 14,448 words. One fourth of the class has a reading vocabulary of 12,768 words or less, while one fourth of the class has a vocabulary of 17,808 words or more. One half the class ranges within 2,520 words of the median. The whole class ranges from 6,720 to 21,504 words. In a similar way the other columns are read.

It will be noticed from Table II that the progress from grade to grade is quite constant and averages about 3300 words.

In order to measure the range of vocabulary of any class, the task of giving an individual oral test is too great for practical use. The difference between the oral test and the written test in which a pupil is asked to mark words as unknown, known or uncertain is shown by reference to Table III.

Table III

Grade	V	VI	VII	VIII
Median Vocabulary Oral Test	14,448	17,106	20,830	24,192
Checked Word Test	16,870	17,136	21,840	24,864
False Definition Test	16,800	19,480	21,160	24,192

Table III shows rather striking similarity in results by the use of a marking method. In no case is the variation over 2400 words, or approximately 14%. In the Checked Word Test the average difference from the Oral Test is 1000 words or about five per cent. The greatest difference is in the fifth grade which shows a tendency to overestimate.

The above results as to the size of the vocabulary is based upon the calculated estimation that Webster's Elementary School Dictionary contains 33,600 commonly used words. From this list the one hundred words were selected at random.

The author claims that the dictionary contains 45,000 words. Using this number as the basis for calculation, the size of the vocabulary is increased 34 per cent, or approximately one third. The size of vocabulary on this basis is shown by Table IV.

Table IV

Grade	V	VI	VII	VIII
Oral Test	19,350	23,850	27,900	32,400
Checked Word Test	22,500	22,950	29,150	33,300
False Definition Test	22,500	26,100	28,350	32,400

Table IV is read as follows: the reading vocabulary of the median pupil in the eighth grade was 32,400 in the oral test. It was the same in the false definition test and 33,300 in the checked word test. Similarly the other grades are read.

Doctor Daniel Starch, University of Wisconsin, has determined the extent of vocabularies of children in grades five, six, seven and eight. Dr. Starch used the Webster's Unabridged Dictionary. A comparison between the results secured by the use of the Starch English Vocabulary Test and tests previously described in this article is shown in Table V.

Table V

Grade	V	VI	VII	VIII
Starch Test	21,840	27,040	31,200	41,600
Starch Standards	27,040	31,200	34,320	38,480
Elementary School Dict. Oral Test Vocabulary	19,350	23,850	27,900	32,400

Table V is read as follows: in grade V the size of the vocabulary of these pupils as determined by the Starch Test was 21,840, which is 5200 words below the standard determined by Dr. Starch. The size of the vocabulary determined by an oral test using Webster's Elementary Dictionary as previously explained is 19,350 words, a difference of only 2,490 words. In the same manner the figures for the other grades are read.

It is seen from the above discussion that the extent of a pupil's vocabulary will vary according to the dictionary used and whether the actual number of words claimed by the authors of the dictionaries or the number of words determined by counting are used. The difference in vocabulary size made by the use of a large or small dictionary is small. The average difference with these pupils is 4500 words. The actual difference in each grade is less than 3000 with the exception of the eighth grade which shows a difference of 9000 words.

The result of this study seems to indicate that an average pupil in fifth grade, age eleven years, has at least a reading vocabulary of about 15,000 words. It may vary as much as 6000 words according to these measurements or 12000 words according to the standards set by Dr. Starch, reaching 21000 or 27000 words. An average sixth grade pupil, age twelve years, knows at least 18000 words and ranges as high as 31000. An average seventh grade pupil, age thirteen, has a minimum vocabulary of 21,000 words and may range as high as 34,000 words. An eighth grade pupil will have the use of at least 24000 words and may know as high as 38000.

It is not claimed that these figures are final. It is believed, however, that they do show results sufficiently reliable to be indicative and significant.

After this manuscript was prepared, Professor Seashore reports having used the above as an information test in the selection of radio operators with the following two changes:

First: The examiner took each paper in the order in which the men were ready and marked the two most difficult words that had been checked in each of the four columns. He then required the person tested to use each of these eight words correctly in a sentence. For each failure, two points of merit were deducted. He thinks that this affords a satisfactory control of the checking particularly if internal evidences are taken into account. The test then becomes a test of "writing vocabulary."

The second change was to substitute the words, fa, friar and olivoid, for the three proper names in the original list, for evident reasons.

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Superintendent of Schools,
Mason City, Iowa.

TRANSFER AND INTERFERENCE IN CARD-DISTRIBUTING

The object of this study was to discover the transfer and interference effects in card-distributing. The experiment consisted in distributing 150 cards into the 30 compartments of a box. The compartments were arranged in six rows of five each, and were numbered from 11 to 40. The cards were numbered correspondingly, five of each number. The compartments were not numbered consecutively, but quite without system. Before the beginning of each experiment the cards were always thoroughly shuffled.

The subjects were eight University women. They worked in two groups of four each. Practice was for approximately one hour daily. Part of the time was consumed in collecting and shuffling the cards.

The compartments were numbered in two ways, which we shall call scheme 1 and scheme 2. In scheme 2 the same numbers were used but *applied to different compartments*, and entirely without system as in scheme 1.

Group A alternated from scheme 1 to scheme 2 from day to day throughout the experiment, 30 days. Group B used scheme 1 only, for fifteen days, and then scheme 2 only.

We shall first notice the transfer effects. In figure I the results of the whole experiment are shown graphically. The vertical axis represents seconds; the horizontal, days. The practice curves are plotted from the daily averages of each of the two groups.

On the 16th day group B began to use scheme 2. Their average distribution time on this day was only 42.8% of the average time of distribution on the first day with the first scheme. These results show that in spite of the inhibitory effects of the habits established in the first fifteen days, efficiency in scheme 2 was much greater the first day than it had been the first day with scheme 1. On the fourth day with scheme 2 group B lacked only 3 seconds making the time attained on the fifteenth day in the first scheme.

In figure II are shown the results of the first five practices of group B with schemes 1 and 2. In scheme 2 the records are very much better than in scheme 1, showing not only rapid initial speed but also rapid improvement.

It is clear from this experiment that in distributing cards one gains efficiency in mastering such situations. After building up a system of habits for one scheme, a subject can more quickly build up a system of habits for another scheme. What is the explanation? There are probably several factors involved. In the first place, in our experiment the two systems of habits are not entirely different. The stimuli are the same, and the responses are the same, but the stimuli are coupled with different responses in the two cases. Whatever facilitation there is in the passage of nerve impulses through the neurones involved, arising from practice in the first experiment, is available and effective in the second experiment. Only *one* new nerve coupling has to be made for each card-number in the second experiment. This is more easily made than all the couplings originally involved.

In the first experiment the subject acquires skill in perceiving and recognizing the card-numbers; in getting the cards out of the pack; in getting them to the appropriate compartments. All these skills are effective in the second experiment. The transfer effect here is great, but entirely explainable from the standpoint of identical elements involved.

A comparison of A and B in figure 1 shows the inhibitory effects of one set of habits on the formation of the other. Group A alternated from one scheme to the other from day to day. If we may judge from the first day's work, they were faster learners than group B, but the efficiency which they acquired was much less.

Group A's final speed was 10% slower than group B's in scheme 1, and 22% slower in scheme 2.

The comparison can be made in another way: in the case of group B the final speed in the two schemes averaged 19% of first day speed, while in the case of group A the average final speed for the two schemes was 24% of their first day speed. Therefore, whether we compare absolute speed attained, or compare the absolute final speed with initial time, the result is the same. The group that alternated from one scheme to the other from day to day was at a great disadvantage in its method.

The inhibitory effects are further shown by reference to figure III. In the first fifteen days of the experiment, as shown in figure I, group B learns very much faster than group A, but at any time up to the fifteenth day, group B has had twice as much practice on scheme 1 as group A has had, for group A is also perfecting another set of habits; namely, those involved in scheme 2. In figure III are shown the records for group B for the first fifteen days, and all the records of group A for scheme 1, *i. e.*, the records on alternate days for thirty days. At any time after the first day's record, therefore, group A has had twice as much practice in distributing cards as has group B. In spite of this fact, however, owing to the inhibition of scheme 2 on scheme 1, group A does not attain the skill in scheme 1 attained by group B.

The inference from this experiment is that it is not economical to form at the same time two mutually inhibitory sets of habits. The better procedure is to form one, and then the other.

University of Missouri. W. H. PYLE.

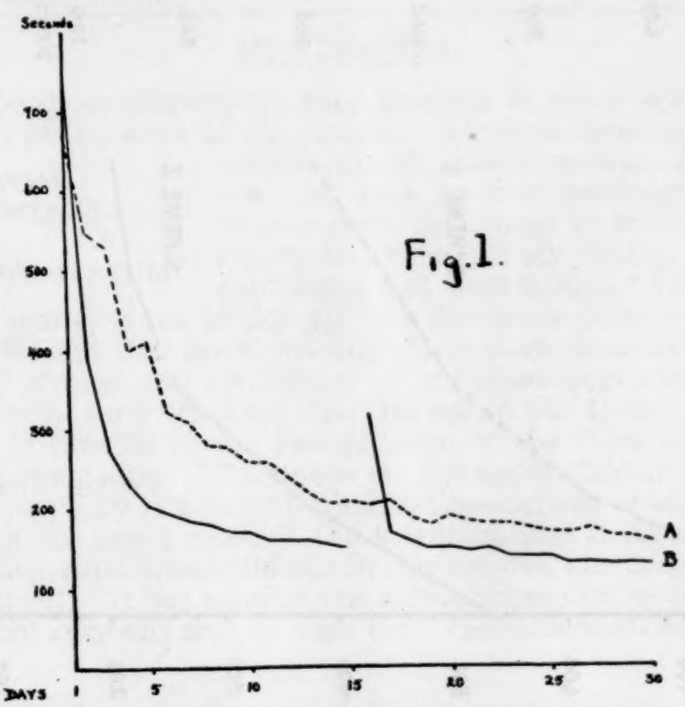

Figure 1. B shows the record for the group distributing 15 days with scheme 1, then 15 days with scheme 2. A shows records of group alternating between the two schemes from day to day for 30 days.

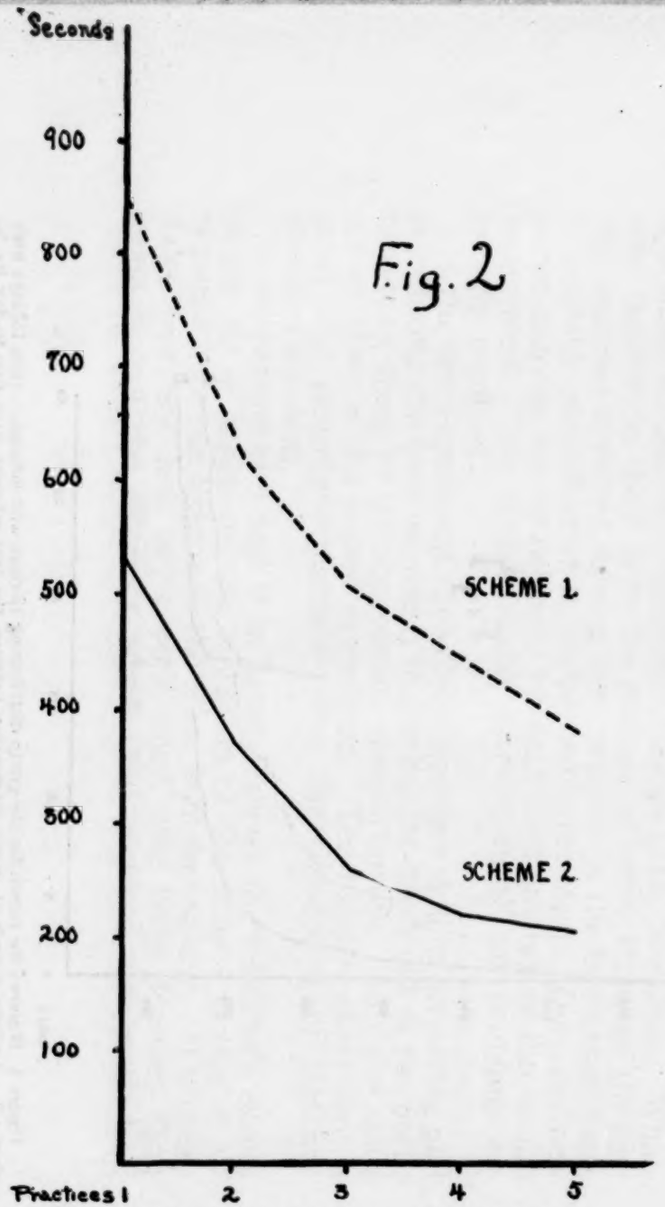

Fig. 2

Figure 2. These graphs show the records for the first five distributions of group B with schemes 1 and 2. The effects from scheme 1 greatly reduces the time in scheme 2.

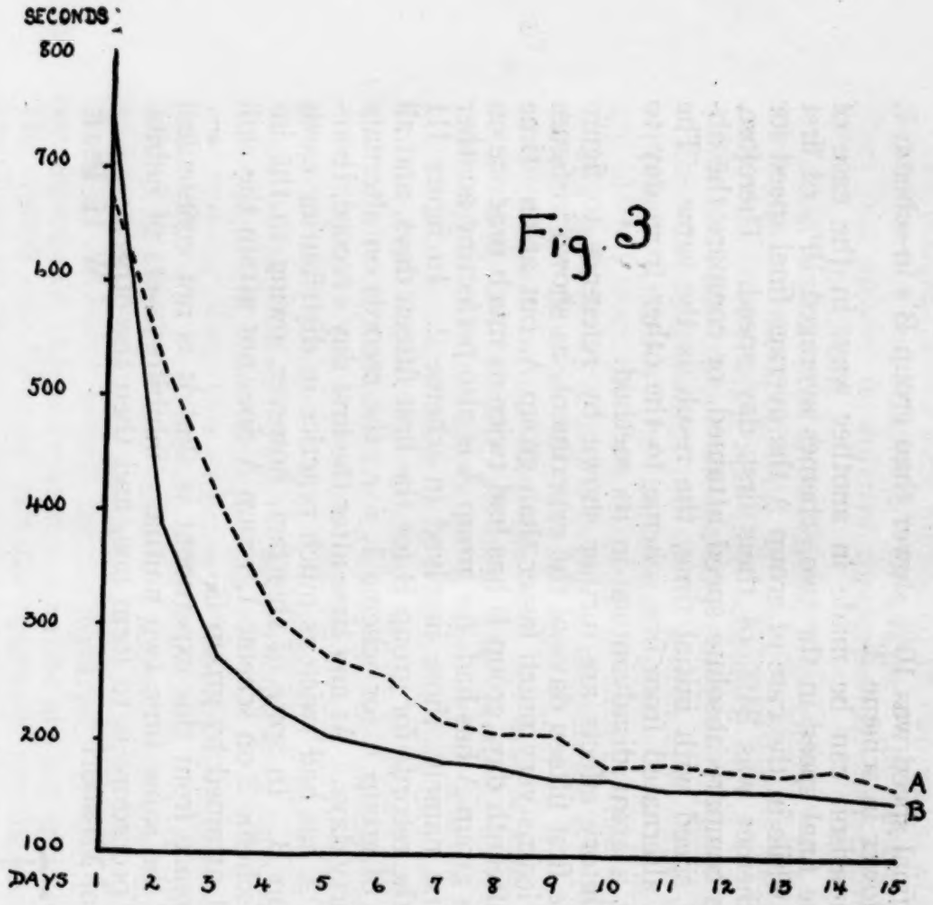

Fig. 3

Figure 3. B shows the speed records for the group distributing daily according to scheme 1. A represents the records for scheme 1, of group A, distributing over a period of 30 days on alternate days. At any point after the first day, group A has had an equal experience with group B in scheme 1, and in addition, an equal amount of practice in scheme 2.

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EDITORIAL

EDUCATIONAL MEASUREMENTS AND THE CLASSROOM TEACHER

Educational measurements may be used in many ways for the evaluation of the work of the schools. Three of these uses may be singled out for special notice. First, they may be used by a commission or other outside body appointed to investigate and report on the efficiency of the school organization and instruction. This is illustrated in many of the school surveys that have been made in the last decade, and that have probably done more than anything else to spread abroad the conception of standard educational scales. A noteworthy early instance was the use of the Courtis Standard Tests in Arithmetic in the investigation of the New York School Inquiry Commission. The report on the application of these tests in New York City is a contribution to the scientific study of education which has never received the attention that it deserves. The use of educational measurements in this manner has unquestionably justified itself. It has enabled the survey commissions to get away from casual opinions and to base their recommendations on objec-

tively verified facts. It has given us results from widely separated communities which are gradually crystallizing into norms of performance. On the other hand these raw scores fail to give a faithful picture of the school situation, and need to be interpreted and explained in the light of other considerations which are frequently ignored.

A second use of educational measurements is seen in the activities of the special bureaus for educational research that are being established in an increasing number of school systems. It is the function of such a bureau to keep up a sort of continuous survey from within the system, and its influence is unquestionably more salutary and lasting than the transient survey from without. The directors of these bureaus are among our foremost students in educational research, and are gradually accumulating a mass of data which is already having its effect upon the organization and administration of schools, and which is bound to be of increasing significance in the future. Many practical school men take the view that educational measurements are so technical and require such a high degree of training that they ought to be left entirely to the expert specialists of such bureaus. Without ignoring the need for many more such specialists in the schools than we have at present, and without derogating from the splendid work that research bureaus are doing, it may be contended that this is not the chief service that educational measurements may render the schools. So long as measurements are regarded as the province of highly trained technicians the results will be kept at a respectful distance by principals and teachers.

The third and most beneficial use of educational measurements will be that by the principal and classroom teacher as a regular part of the school routine. We must disabuse our minds of the notion that measurements are something esoteric and abstruse. There is not a scale or a test now before the public that cannot be given, scored and tabulated by an intelligent teacher with a little careful practice. Measurements, instead of being looked upon by the teacher as the mysterious functions of a remote bureau, will come to be regarded as the teacher's useful tools, whereby she can determine quickly and accurately the needs of her pupils and the most effective adjustment of her energies. To this end many of our directors of research bureaus are making noteworthy contributions. Instead of more work for the teacher measurements mean in the long run less work, and much easier and more successful work. The recognition of the value of measurements for the teacher can only come about through the encouragement of the supervising staff. When superintendent, principal and teacher unite whole-heartedly to study the needs and capacities of individual children and to base the school work upon their findings, much of the drudgery and grind of teaching will disappear, and educational measurements will attain their greatest usefulness.

J. C. B.

NOTES AND NEWS

Dr. C. Truman Gray, of the University of Texas, has recently issued his Standard Score Card for Measuring Handwriting in four different forms. Form 1 is intended for training purposes, Form 2 has spaces for recording the score for each of the ten months of the school year, Form 3 is 17″ by 22″ in size and is intended to be hung on the wall of the school room for class use, and Form 4 is to be used as a report card to parents. These cards will be supplied to teachers at cost plus postage. At present Forms 1 and 2 cost fifty cents per hundred, Form 3 ten cents each, and Form 4 thirty cents per hundred.

The Frasier Writing Scale has recently been issued by the Department of Education of the State Normal School at Cheney, Washington. It is constructed on the basis of the Thorndike Scale from samples collected from the fifth, sixth, seventh and eighth grades of the Spokane Schools. The value of each step is given in terms of the Thorndike Scale, and norms for each grade are indicated, based on Freeman's standards. Advantages claimed for the scale are that the samples are all of slant writing, the same text is used in each sample, the samples are on lined paper like ordinary writing, and the scale is arranged with especial reference to its use by children.

Superintendent Ernest C. Witham, of Southington, Ct., has published a new series of Standard Geography Tests, The United States. These are issued in convenient form for class use, and contain nine tests, including an outline map of the United States, its bounding countries, native state and its capitol, ten rivers, five mountain ranges, five bodies of water, fifteen cities, five states, and ten industrial regions. The test is intended for the sixth grade or above, and the author supplies directions for giving and scoring the test, class record sheets, and blanks for graphs.

Dr. S. L. Pressey, of Indiana University, has devised two interesting series of "cross-out" tests for mental survey work. Each consists of four tests, as follows: Series 1, Primer Scale, I. Dot pattern test (in each group cross out the "extra" dot); II. Classification test (in each square cross out the thing that is different from the other two); III. Form board puzzle. (in each square cross out the piece you will have left over after you have fitted all the other pieces into the four forms at the top of the page); IV. Absurdities (in each square cross out the part of the picture that is wrong). Series 2, I. Verbal ingenuity (disjointed sentences containing one extra word to be crossed out); II. Logical judgment (in each list of five words cross out the thing that doesn't belong with the other four); III. Arithmetical ingenuity (in each set the

numbers are arranged according to a rule, but there is one number that breaks the rule. Cross it out); IV. Moral judgment (in each list of five acts cross out the one that is worst). The reactions of school children to these tests should furnish very interesting material. The tests are planned for the comparison of classes and schools as to the average of distribution of the abilities of the children, as to the classification of children according to ability, and as a check on other tests. Each scale takes twenty-five minutes to give, and can be scored in less than a minute.

Dr. L. W. Sackett, of the University of Texas, has issued his Scale in Ancient History in convenient booklet form, with blank spaces for the pupil's personal report, direction for giving the tests, the scale values opposite each question, directions for scoring, and June standards for each grade and sex in each test. Dr. Sackett is also working on a new form of United States History test which he expects to have ready by next fall.

Among the investigations in progress by the University of Illinois Bureau of Educational Research, Dr. B. R. Buckingham, Director, are the derivation of the following scales: A scale for reasoning problems in arithmetic, a geography scale for the seventh and eighth grades, a history scale for the seventh and eighth grades, an English grammar scale for the same grades, standard requirements for memorizing literary material, and a group mental test for young children.

Mr. S. A. Courtis, director of educational research in the Detroit public schools, has issued a series of standard supervisory tests designed to further the use of tests as a routine school measure. The tests include spelling, arithmetic, geography and writing, and the descriptive folder of 52 pages contains in addition to much other valuable matter a percentage table and a table of rate-interval scores. With each test go individual and class record cards, and duplicate record sheets, half to be kept by the teacher and the other half to be sent to the principal or superintendent. On these record sheets the scores appear in five groups, children of standard ability who need no drill, those for whom the regular work will furnish sufficient drill, those in need of thorough drill, those needing special attention and extra drill, and those requiring special adjustment of work. While the bookkeeping looks somewhat formidable, there is little doubt that teachers who take and use such records will be able to do much more effective work than is usually attained.

The Adjutant General's Office of the War Department announces that a history of personnel work is now being prepared and will shortly be published in two volumes under the general title "The

Personnel System of the United States Army." Volume I, "The Evolution of the Personnel System," gives a history of the development of the work; Volume II, "The Personnel Manual," contains the operating instructions for the system as it existed on November 11, 1918. Further information regarding this publication may be obtained from Lt. Col. E. K. Strong, Jr., 528 State, War and Navy Building, Washington, D. C.

The general topic of the January meeting of the New York Society for the Experimental Study of Education was "Problems in Science Teaching." Professor Maurice A. Bigelow, of Teachers College, discussing "Problems Concerning the Content of General Science," raised questions in regard to the fundamental purposes of general science, to the content of the course, and to the best methods of approach. Dr. Otis W. Caldwell, of the Lincoln School, gave an account of the "Gary Science Survey," describing some very interesting tests used in it to determine whether "science trains in the observation and discrimination of things worth while." Principal John E. Wade described experiments in the teaching of science in elementary schools, and Mr. John McCarthy, Principal of the Singer Evening School, spoke of science in relation to shop needs.

Among the many interesting papers on the program of the meetings of the Department of Superintendence and affiliated societies at Chicago, February 24–28, we note the following: "The Relation between Study and Reading" by William S. Gray, University of Chicago, "Intelligence Testing as an Aid to Supervision", by Theodore Saam, Council Bluffs, Iowa; "Procedure with Standard Tests in the Supervision of English Teaching" by C. C. Certain, Detroit, Mich.; "Some Measurements of a Class of Children of Superior Intelligence" by Henrietta V. Race, Louisville, Ky.; "Results of Supervised Study in English as Measured by the Harvard-Newton Scale" by Charles Fordyce, University of Nebraska; "Measuring the Effects of Supervision in Geography" by S. A. Courtis, Detroit; "Variation in the Spelling of Root and Derived Forms of Words" by Ernest J. Ashbaugh, University of Iowa; "The Reading Problem in the Public Schools, as Affected by Actual Measurements" by Joseph P. O'Hern, Rochester, N. Y.; "Diagnosis as a Result of Measurement in Fractions" by Arthur W. Kallom, Boston; "Psychological Service in the Army and its Meaning for Educational Purposes" by Major M. E. Haggerty; "Educational Research from the Point of View of the Superintendent" by C. E. Chadsey, Detroit; "Organization for Effective Research" by Wilford E. Talbert, Carnegie Institute of Technology; "Citizen Co-operation in Educational Research" by F. E. Shapleigh, Buffalo, N. Y.; "What Educational Results of the Kindergarten may and may not be Measured?" by Alice Temple, University of Chicago, Julia Wade Abbott, Washington, D. C., W. C. Bagley, Teachers College, and Lotus D. Coffman, University of Missouri.

The National Society for the Study of Education has a Committee on the Materials of Instruction, Professor C. H. Judd, University of Chicago, chairman, which is endeavoring to collect materials and devices now being successfully used by individual teachers, and to make these more widely known and generally accessible. The committee is concentrating its attention on grades seven to nine, and is seeking information on books and materials used, on original work by individual teachers, and on plans for organizing correlated courses in these grades.

Dating from the present semester every course in the freshman and sophomore years of Yale University will be required. The required courses include economics, philosophy and American and European history.

Professor H. Austin Aikins recently gave two lectures at the Carnegie Institute of Technology, Pittsburgh, before the occupational therapy class on problems of psychotherapy and the work in Canadian hospitals of importance for occupational aids. At the same institution Lt. Col. E. K. Strong, Jr., spoke on job analysis before the Research Bureau for Retail Training.

At the Baltimore Meeting of Section L (Education) of the Association for the Advancement of Science Professor V. A. C. Henmon, of the University of Wisconsin, was elected vice-president.

Miss Lida Lee Tall, supervisor of grammar grades of Baltimore, Md., has been appointed supervising principal of the first six grades at the Lincoln School, New York City.

PUBLICATIONS RECEIVED

WILLIAM H. ALLEN. *War Fact Tests for Graduation and Promotion.* Yonkers-on-Hudson: World Book Company, 1918. Pp. 80. Twenty-four cents.

A pithy statement of the reasons why we are at war, our peace aims, home town war facts, home state war facts, home country war facts, world war facts and after-the-war needs. The home town and state war facts are left somewhat schematic, and directions are given for securing and inserting the appropriate data. The book has been approved for use in New York City schools.

F. MATTHIAS ALEXANDER. *Man's Supreme Inheritance. Conscious Guidance and Control in Relation to Human Evolution in Civilization.* New York: E. P. Dutton and Company, 1918. Pp. xvii, 354. $2.00.

This is a thesis on the importance of correct breathing. The author has much to say comparing modern conditions of life with the habits of primitive man, and both on general grounds and on the basis of specific cases urges the importance of "respiratory re-education." Incidentally he voices many good ideas about "the open mind," and the value of a scientific point of view. The book has a commendatory introduction by John Dewey.

FRANCIS G. ALLINSON, Editor. *The Aeneid of Virgil.* In English translation by John Connington. New York: Scott, Foresman and Company, 1916. Pp. 452. Forty cents.

One of the strongest arguments in favor of the Greek and Latin languages has been the educative influence of contact with the masterpieces of their literatures. But modern educators are coming to believe that this result can be better attained, with much saving of time and energy, through translations. It is therefore, with satisfaction that we note the issue of this school edition of the best known prose translation of Virgil's Aeneid. We believe that young people can be gotten to read this classic with real interest and enthusiasm, and that in three months' time a vastly better idea can be gained of the great Latin epic than from a three years' study of the Latin language.

FRANK P. BACHMAN. *Great Inventors and Their Inventions.* New York: American Book Company, 1918. Pp. 272. $.80.

Twelve stories of great inventions, with a concluding chapter on the famous inventors of to-day. There are accounts of the development of steam and electric power; of such manufactures as the cotton gin, spinning machines, sewing machines, reaping machines and making of steel; means of communication, as printing, telegraph, and telephone; and recent inventions, as the electric light, flying machines, wireless telegraphy, and submarine boats. This is really educative reading material.

LYDIA RAY BALDERSTON. *Housewifery: A Manual and Text Book of Practical Housekeeping.* Philadelphia: J. B. Lippincott Company, 1918. Pp. 353. $2.00.

This is another of the excellent Lippincott's Home Manuals. In it the previous high standard of usefulness, scientific accuracy, and mechanical perfection has been worthily maintained.

MAURICE BARRES. *Les Traits Eternels de la France.* New Haven: Yale University Press, 1918. Pp. 90. $1.00.

An address delivered before the British Academy in the hall of the Royal Society, July 12, 1916, in which the noted French Academician pays tribute to the character of the French soldier and to his loyalty and devotion to France.

ARTHUR L. BEELEY. *An Experimental Study in Left-Handedness, with Practical Suggestions for Schoolroom Tests.* Chicago: University of Chicago Department of Education, 1918. Pp. viii, 69. $0.50.

The uniformity of action demanded in ordinary school procedure makes the position of the left-handed child awkward and embarrassing. Shall the child be taught to prefer the use of the right hand in acts of skill, as do normally right-handed children? At present we have only masses of conflicting opinion. At the very outset we are confronted with the difficulty of diagnosing left-handedness, and of determining whether it is inherited or acquired. Extended experiments with the Jones brachiometer convinced the author that this instrument is absolutely unreliable as a test of left-handedness, and the most effective means of diagnosing the condition is offered by the tapping test and a tracing test devised by the author. The susceptibility of left-handed children to "mirror-writing" is due to the dominance of motor over visual controls of movement. The monograph closes with a concise summary of the literature on left-handedness, and a bibliography of 36 titles.

MILTON BENNION. *Citizenship: An Introduction to Social Ethics.* Yonkers-on-the-Hudson: World Book Company, 1917. Pp. xviii, 181.

The times are ripe for a new statement of the fundamental principles of right living, and the author of this book has rendered a service in proposing for the benefit of high school pupils a series of inquiries as to what we should do about many of the civic and social problems that confront us daily. There is a list of questions on each chapter.

J. D. BERESFORD AND KENNETH RICHMOND. *W. E. Ford: A Biography.* New York: George H. Doran Company, 1917. Pp. 318. $1.35.

A sympathetic and appreciative account of an English teacher and philosophical thinker who tried to apply the ideals of Comenius and Pestalozzi to the conditions of modern life. The book is denominated "the story of a man who lived before his time," but to the reviewer it would seem rather the tragedy of a sensitive spirit who neglected to make use of the methods of advertising which the age requires. It is to be hoped that the book will help to awaken the public in both England and America to demand greater sincerity and more vital earnestness in education.

LEE BYRNE, EDITOR. *The Syntax of High School Latin.* Chicago: The University of Chicago Press, 1918. Pp. xi, 60. $0.75.

The volume contains an interesting analysis of the mental processes involved in reading simple passages of Latin prose, and presents detailed statistics of the frequency of different types of constructions in the selections usually read in high school Latin. There follow pertinent suggestions on the relative time and emphasis to put on various phases of syntax in the material of the course. The book is invaluable to the teacher of Latin.

WILL DURANT. *Philosophy and the Social Problem.* New York: The Macmillan Company, 1917. Pp. x, 272. $1.50.

By the social problem the author means the problem of reducing human misery by modifying social institutions. Reflecting on the upheaval in Russia, the increase of interest in socialism all over the world, and the probable readjustments that we shall be called upon to face after the war, we readily grant the tremendous significance of this problem. The author believes that the solution is to be found only through philosophy, and devotes two-thirds of the book to an interpretation of the contributions of Socrates, Plato, Bacon, Spinoza and Nietzsche to the betterment of society. The remainder of the book is a plea for the dignity and importance of philosophical thinking at the present time. His plan is to organize the intelligence of the world to improve life, just as both the Germans and the Allies have organized the material and spiritual resources of the world to destroy life. It is an admirable scheme, and worthy of wide-spread consideration.

GEORGE ELIOT. *The Mill on the Floss.* Edited for school use by C. H. Ward. New York: Scott, Foresman and Company, 1916. Pp. 501. Forty-five cents.

This, the most recent volume of the Lake English Classics, is not overburdened with notes and allows the reader to maintain uninterrupted contact with the story.

N. L. ENGELHARDT. *A School Building Program for Cities.* New York: Teachers College Contributions to Education, 1918. Pp. ix, 130.

Most of our American cities have changed so rapidly in population in the past fifty years that a school building program has been made very difficult. Most cities have been satisfied to lag a goodly distance behind their building needs, and could scarcely be said to have any building program whatever. This volume presents systematic comparative studies of the populations of a group of medium-sized cities, considers the trend of practice regarding the details of the school plant, and gives valuable data on financing a building program. The investigation will be a boon to the superintendents of our city schools.

THOMAS E. FINNEGAN. *Teacher Training Agencies. A Historical Review of the Various Agencies of the State of New York Employed in Training and Preparing Teachers for the Public Schools of the State.* Albany: State Department of Education, 1917. Pp. 439.

An account of the Lancasterian schools, the training classes in the earlier academies, a history of each of the state normal schools, and city training schools, and a description of the facilities for training teachers in the other institutions of the state. The volume is sumptuously and profusely illustrated.

SIDNEY G. FISHER. *American Education.* Boston: Richard G. Badger, 1917. Pp. 171. $1.25.

This is a powerful and well-supported arraignment of present educational practices in America, with especial reference to secondary and higher education. The old cry that the American youth is two years behind his European fellow is revived with copious citations. Our schools pander to information and are too weak to furnish the rigorous disciplinary training that European schools provide. Teaching has become debased by catering to the interests and whims of the pupils. Our college faculties have abdicated in favor of the athletic coach, and the fraternity. Crowning crime of all our courses of study have been disorganized by the pernicious

elective system, and their entire effect is a mass of weakness, shilly-shallying, and inefficiency. It is a veritable Jeremiad, and will meet with much approval from those who lament the decay of the good, old times.

FLORENCE C. FOX. *The Fox Series of Readers. The Fox Primer from Mother Goose.* Pp. 170. *The Fox First Reader.* Pp. vii, 156. *The Fox Second Reader.* Pp. v, 187. *The Fox Manual for Teaching Reading.* Pp. viii, 62. New York: G. P. Putnam's Sons, 1918.

This attractive series of readers is constructed on the principle of socializing the recitation. In so far as possible direct discourse is used, and the narrative parts are so divided that they can be assigned to various pupils. In the primer much attention is given to phonic exercises and to oral story-telling.

FRANK N. FREEMAN. *The Handwriting Movement. A Study of the Motor Factors of Excellence in Penmanship.* Chicago: University of Chicago, Department of Education, 1918. Pp. xvi, 169. $1.25.

This monograph presents the results of an extended experimental investigation of writing movements carried on in the University of Chicago laboratory under a grant from the General Education Board. It is unquestionably the most thorough and elaborate study of writing movements yet made. There is an analysis of individual records from motion-picture studies, a statistical comparison of the position and movement of good and poor writers, and an account of a field study and a pedagogical experiment in writing. The author urges that the pupil be taught to take a critical attitude toward his writing, and that he be afforded definite knowledge of his standing and progress. Letters, he says, may be formed by such a combination of finger and arm movement as is most natural to the pupils.

GEORGE W. GERWIG. *Schools with a Perfect Score.* New York: The Macmillan Company, 1918. Pp. xiii, 194. $1.10.

This is not a statistical comparison of schools rated on the basis of standard tests, as one might surmise from the title. The author's aim is rather to picture in vivid fashion certain ideals of school grounds, school buildings, the activities of teachers, intellectual education, vocational education, and moral training. The book closes with a scathing arraignment of the defects of present school practices, and a summary of specific improvements to correct these defects.

WILLIAM ERNEST HOCKING. *Morale and its Enemies.* New Haven: Yale University Press, 1918. Pp. xvi, 200. $1.50.

"Morale, the invisible force behind war-making, is also the invisible force behind peace-making. It is the temper of a people expressing itself in action,—in war and in reconstruction. The conscious need of understanding and calling upon the high possibilities of that temper has never before been so recognized by a nation." This is one of the best philosophical analyses of the factors involved in the war. The author was director of the courses on Morale in the Northwestern Division of Army Camps during the summer of 1918, and has brought to bear on the problems of maintaining the war spirit the keen philosophical insight which has characterized his thinking in other fields.